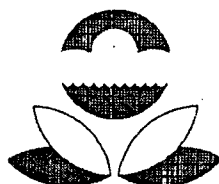


# START

Superfund Technical Assessment and Response Team  
- Region VIII

197869



United States  
Environmental Protection Agency

Contract No. 68-W5-0031

## SAMPLING ANALYSIS REPORT FOR REMOVAL SITE ASSESSMENT

North Denver Residential Soils  
Denver, Colorado

TDD No. 9712-0003

July 6, 1998



# URS

OPERATING SERVICES, INC.

**SAMPLING ANALYSIS REPORT  
for REMOVAL SITE ASSESSMENT**

**NORTH DENVER RESIDENTIAL SOILS  
Denver, Colorado**

**EPA Contract No. 68-W5-0031  
TDD No. 9712-0003**

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Mark Rudolph, Environmental Scientist, UOS

Approved: \_\_\_\_\_ Date: \_\_\_\_\_  
Peter Stevenson, U.S. Environmental Protection Agency, Region VIII

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## **SAMPLING ANALYSIS REPORT for REMOVAL SITE ASSESSMENT**

### **North Denver Residential Soils**

### **Denver, Colorado**

## **TABLE OF CONTENTS**

	<b><u>PAGE #</u></b>
<b>SIGNATURE PAGE</b>	<b>i</b>
<b>DISTRIBUTION LIST</b>	<b>ii</b>
<b>TABLE OF CONTENTS</b>	<b>iii</b>
<b>1.0 INTRODUCTION</b>	<b>1</b>
<b>2.0 SITE BACKGROUND</b>	<b>1</b>
<b>3.0 SITE ACTIVITIES AND OBSERVATIONS</b>	<b>2</b>
<b>4.0 QUALITY ASSURANCE AND QUALITY CONTROL</b>	<b>3</b>
<b>5.0 ANALYTICAL DATA EVALUATION</b>	<b>4</b>
<b>6.0 SAMPLE RESULTS</b>	<b>5</b>
<b>7.0 SUMMARY</b>	<b>8</b>
<b>8.0 LIST OF REFERENCES</b>	<b>9</b>

## **FIGURES**

Figure 1	Site Location Map
Figure 2	Surface Soil Arsenic Concentrations
Figure 3	Depth Soil Arsenic Concentrations
Figure 4	Surface Soil Lead Concentrations
Figure 5	Depth Soil Lead Concentrations

## **TABLES**

Table 1	Surface Soil Sample Results Summary
Table 2	Depth Soil Sample Results Summary
Table 3	Summary of Properties - Arsenic and Lead / Surface and Depth Results Summary
Table 4	North Denver Residential Soils Spectrace 9000 XRF Data
Table 5	North Denver Residential Soils XRF/Laboratory Comparison



## TABLE OF CONTENTS (continued)

### GRAPHS

Graph 1	XRF / Laboratory Data - Linear Regression Analysis & 95% Confidence Intervals - Arsenic
Graph 2	XRF / Laboratory Data - Linear Regression Analysis & 95% Confidence Intervals - Arsenic
Graph 3	XRF / Laboratory Data - Linear Regression Analysis & 95% Confidence Intervals - Lead
Graph 4	XRF / Laboratory Data - Standardized Residuals - Arsenic
Graph 5	XRF / Laboratory Data - Standardized Residuals - Lead
Graph 6	XRF / Laboratory Data - Relative Percent Differences - Arsenic
Graph 7	XRF / Laboratory Data - Relative Percent Differences - Lead

### APPENDICES

Appendix A	Validation Reports
Appendix B	Laboratory Data and Validation Reports (Under Separate Cover)
Appendix C	XRF Data Packages - Volumes I, II, and III (Under Separate Cover)
Appendix D	Field Data Sheets - Volumes I and II (Under Separate Cover)

## 1.0 INTRODUCTION

URS Operating Services, Inc. (UOS) has been tasked by the U.S. Environmental Protection Agency (EPA), Region VIII, under Technical Direction Document #9712-0003, to conduct residential soil sampling in North Denver, Denver County, Colorado. Field work for Phase I of the North Denver Residential Soils (NDRS) project was completed on March 2, 1998, and from April 14 through 28, 1998.

A total of 3,550 soil samples were collected from parks, schools, and residences in the Elyria and Swansea neighborhoods, as proposed in the Final Sampling and Analysis Plan (SAP) (URS Operating Services, Inc. (UOS) 1998). All details regarding sampling and analytical procedures may be reviewed there. Boundaries for this sampling effort were Colorado Boulevard on the east, the South Platte River on the west, East 38<sup>th</sup> Avenue on the south, and East 56<sup>th</sup> Avenue on the north. Soil samples collected were analyzed for arsenic, cadmium, and lead by a TN Spectrace 9000 X-Ray Fluorescence Spectrometer (XRF).

Soil sampling results were incorporated into a Microsoft® Access database and combined with Global Positioning System (GPS) coordinates and other pertinent sampling data. This database was then utilized for mapping by the EPA Geographic Information System (GIS) contractor ISSI, Inc. The base map used for the GIS database was a digital aerial photograph of the site area.

## 2.0 SITE BACKGROUND

The Colorado Department of Public Health and Environment (CDPHE) collected 25 soil samples from residential yards in North Denver on July 16, 1997. Samples were collected from residential yards located immediately north of the elevated portion of Interstate 70 in the Elyria and Swansea neighborhoods of Denver, Colorado. More specifically, the samples were collected from the 4600 and 4700 blocks of Williams Street, Race Street, and Vine Street; the 4600 block of Franklin Street and Baldwin Court; the 4700 block of Fillmore Street and Gaylord Street; and the 4800 block of St. Paul Street (Colorado Department of Public Health and Environment (CDPHE) 1998).

These 25 soil samples indicated levels of arsenic ranging from 12 milligrams per kilogram (mg/Kg) to 1,300 mg/Kg, levels of cadmium ranging from 1.8 mg/Kg to 12 mg/Kg, and levels of lead ranging from 61 mg/Kg

to 660 mg/Kg. The discovery of these metals concentrations prompted the need to further investigate the extent of arsenic, cadmium, and lead present in soils in this region of North Denver (CDPHE 1998).

### **3.0 SITE ACTIVITIES AND OBSERVATIONS**

On March 2, 1998, and from April 14 to April 28, 1998, personnel from the Superfund Technical Assessment and Response Team (START) and the Response Engineering and Analytical Contract (REAC) collected a total of 2,363 surface soil samples (0 to 2 inches below ground surface (bgs)), 1,096 depth soil samples (6 to 10 inches bgs), and 91 field replicates, totaling 3,550 soil samples from a total of 1,152 properties in the neighborhoods of Elyria and Swansea in North Denver, Colorado, averaging approximately 3.1 soil samples per property sampled.

Sampling teams and XRF operations included the following START members: Mark Rudolph (UOS), Kent Alexander (UOS), Corey Terry (UOS), Bill Larow (UOS), Crystal Roberts (UOS), Randy Perlis (UOS), Jon Adam (UOS), Christina Howley (UOS), Jan Christner (UOS), Eric Scott (Maxim), Rebecca Laramie (LT Environmental), Dave Hill (Tetra Tech EMI, Inc. (TT)), John Humphrey (TT), and Michelle May (TT). Additional sampling teams and XRF operations personnel from REAC included the following: Ray Lewis, Mike McGill, Jessica Levine, Chris Agnew, Keith Olinger, Yangtzee Aexume, and Gerrard Ball. EPA representatives that directed sampling teams included Peter Stevenson and Alan Humphrey with public relations assistance from Patricia Courtney and Ted Fellman.

All START and REAC sampling personnel adhered to the site health and safety plan generated by UOS prior to field activities. All REAC sampling personnel adhered to the site health and safety plan generated by REAC prior to field activities. All personnel (START, REAC, and EPA) conducted field collection activities in Level D personal protective equipment (PPE). A health and safety tailgate meeting was conducted daily, prior to commencement of field activities each day.

Soil samples were collected as stated in the final SAP. Sample locations were chosen to be representative of the area sampled. All samples collected were grab samples and not composited. Generally, one surface sample was collected from the front of the property, one surface sample was collected from the back of the property, and one sample was collected from 6 to 10 inches bgs at either one of these locations. Surface soil samples were collected with a decontaminated stainless steel trowel or shovel. If a depth sample was to be

collected, the surface soil sampling implement was used to dig to a depth of six to eight inches bgs. A decontaminated sampling implement was then used to collect the next sample at the depth interval. All samples were then labeled and put under chain of custody (COC) as stated in the final SAP, and brought to the START Operations Center located at 401 Park Avenue West in Denver, where the samples were kept under COC. All samples were dried in an oven at approximately 100°C for approximately one hour. After the samples were thoroughly dried, they were sieved through a 10-mesh sieve. The sieved material was then placed in an XRF cup with a Mylar® cover for analysis.

Deviations from the approved Final SAP included the following:

- Sample locations were not photographed as described in the Final SAP. Digital camera pictures were not sufficiently legible for the purpose of returning to the exact sample location; hence, sampling personnel prepared a more detailed sketch of the sampled property and sample locations on the field data sheets (Appendix D, Volumes I and II). This change has no effect on the outcome or reporting of this project.
- Field replicates (two samples collected from one sample interval) were collected at 91 locations (approximately 1 per 38 samples). The Final SAP called for field replicates to be collected at a frequency of 1 per 20. The shortage of field replicates does not have any effect on the quality of any data reporting. Data comparability between the two data sets was good overall with the determination of correlation ( $R^2$ ) on a linear regression analysis above 0.75 for arsenic and lead data sets.
- The Final SAP called for the collection of one rinsate blank per sampling team per day, totaling 45 rinsate blanks for phase I of the NDRS project. During the field activities, two rinsate blanks were collected by each sampling team (three sampling teams). These rinsate blanks were collected on April 20 and on April 24, 1998, totaling six rinsate blanks collected during Phase I of the NDRS project. Decontamination methods for the entire project adhered to the final SAP and remained consistent throughout the duration of Phase I of the project. Laboratory analyses of all rinsate blanks were non-detect for arsenic at a level of 60 µg/L, cadmium at a level of 5 µg/L, and lead at a level of 50 µg/L. The values non-detected for the rinsate blanks indicate that decontamination procedures were thorough, and performed as stated in the final SAP.

#### 4.0 QUALITY ASSURANCE AND QUALITY CONTROL

Two different types of Quality Assurance/Quality Control (QA/QC) samples were collected and analyzed using the XRF instrument. Field replicates (R), two samples collected from one sample interval, were collected at 91 locations (approximately 1 per 38 samples collected). XRF duplicates (D), two aliquots taken from one 8-ounce sample jar, were collected for 179 sample locations (approximately 1 per 19 samples collected).

START adhered to sample collection, packaging, and documentation procedures outlined in the Sampling QA/QC Work Plan approved by the EPA On-Scene Coordinator (OSC) on March 26, 1998 (UOS 1998).

Laboratory confirmation samples were sent to three different laboratories for analysis using Inductively Coupled Plasma emission spectroscopy (ICP) SW-846 Method 6010. Initially, 5 samples were sent on March 4, 1998, to the Roy F. Weston laboratory in Edison, New Jersey, for Target Analyte List (TAL) metals. These 5 samples were for laboratory confirmation of XRF samples collected on March 2, 1998. A total of 44 confirmation soil samples were sent on April 23, 1998, to Analytica Laboratories of Broomfield, Colorado, for the initial set of XRF confirmation samples. These 44 samples were analyzed for TAL metals including mercury.

A total of 319 soil samples were sent on May 1, May 8, May 19, and June 5, 1998, to Paragon Analytics, Inc. in Fort Collins, Colorado, for confirmation of the additional XRF samples collected during the remainder of Phase I of the NDRS project. These 319 samples were sent in four different groups (groups of 120, 120, 68, and 11 samples) and analyzed only for arsenic, cadmium, and lead.

For data comparability, XRF sample cups were sent to the laboratory for confirmation. The site specific Analytical target levels were developed by the EPA Removal Program for this project by taking the state of Colorado risk-based action levels for the Asarco-Globeville project of 70 mg/Kg for arsenic, 70 mg/Kg for cadmium, and 500 mg/Kg for lead. These values were used to adjust the XRF run analysis time to achieve an appropriate detection limit. The detection limit for cadmium (100 mg/Kg) was higher than the risk-based action level for cadmium of 70 mg/Kg.

Confirmation samples were chosen based on two criteria. The majority of samples analyzed with the XRF found to be above either the arsenic analytical target level of 70 mg/Kg, or the lead analytical target level of 500 mg/Kg were sent for laboratory confirmation. If two samples were collected from a property and both had XRF results above an arsenic or lead analytical target level, in some instances, only one of the samples was sent to the laboratory for confirmation analysis. All samples analyzed with the XRF and found to be undetected for arsenic above the arsenic analytical target level (due to lead/arsenic interference) were sent for confirmation analyses using wet digestion chemistry. The remainder of the samples sent to the laboratory for confirmation analysis were either non-detects or randomly chosen and were also sent in for analyses using wet digestion chemistry.

Six rinsate blank samples were sent to Paragon Analytics, Inc. in Fort Collins, Colorado, for arsenic, cadmium, and lead analysis. These rinsate blank samples were all non-detect for arsenic at a level of 60  $\mu\text{g/L}$ , cadmium at a level of 5  $\mu\text{g/L}$ , and lead at a level of 50  $\mu\text{g/L}$ .

All samples were maintained under strict chain-of-custody prior to and during shipment to the laboratory. A label was attached to each sample container, which indicated the sample identification. Sample identification, analysis, sample collection time and date were entered on the chain-of-custody form that accompanied the samples to the laboratory.

## 5.0 ANALYTICAL DATA EVALUATION

All soil samples were analyzed with an XRF on March 3, 1998, and from April 15 to May 19, 1998. XRF field analytical data were evaluated as screening data according to the START Generic Quality Assurance Project Plan (QAPP) with an additional ten percent of these samples being analyzed by an independent laboratory for definitive confirmation analyses (UOS 1997). All XRF data generated for this project were evaluated to assure that instrument calibration, detection limits, energy calibration checks, blank checks, and field replicates were within operational control limits (Appendix C, Volumes I, II, and III). The XRF was operated as per ERT SOP 1713 (Environmental Response Team (ERT) 1995), and per manufacturer's specifications.

Detection limits were calculated for both XRF instruments used for Phase I of the project and additionally for all laboratory confirmation samples. Each XRF instrument used had a unique method detection limit

calculated for it during Phase I of the project. Detection limits were established as a value three times the standard deviation of a low National Institute of Standards and Technology (NIST) certified standard run a minimum of seven times over a specified period of time. In the case of arsenic, the detection limit is as stated above or one-tenth of the lead concentration for that sample, whichever is greater.

Validation of the confirmation laboratory data was completed by TechLaw of Lakewood, Colorado. All data are acceptable for use as qualified in the data validation reports (Appendix A). The complete data validation reports and laboratory forms can be found in Appendix B (under separate cover). Qualifiers used by laboratory validators consisted of U and J. A qualifier of U signifies that the metal was not detected at or above the associated numerical value for that sample. A qualifier for J signifies that the associated numerical value was estimated based on one of many reasons pertaining to laboratory quality assurance. While the value associated with the J qualifier is an estimate, the presence of the metal is reliable. Please refer to the data validation packages for specific criteria for all laboratory confirmation data (Appendix A).

Comparison between laboratory and XRF data indicate that arsenic concentrations detected in XRF analysis were consistently higher than the laboratory analysis but showed good correlation. Laboratory results and XRF results were plotted to determine the relationship between the two data sets. The coefficient of determination ( $R^2=0.913647$ ) indicates that the data are highly correlated.

Comparison between laboratory and XRF data indicate higher variability for lead concentrations than that for arsenic concentrations. Laboratory results and XRF results were plotted to determine the relationship between the two data sets for all confirmation samples. The coefficient of determination ( $R^2=0.6795$ ) indicates that the data are below the target criteria (0.70) stated in the START Generic QAPP. After a review of all lead data and regression analysis, the coefficient of determination was recalculated without four samples (D4669CBF10, D4792HIF10, D3702DEB16, and D4419JOB16) that were outside the 95% confidence interval of XRF vs laboratory results. The recalculated coefficient of determination ( $R^2=0.9054$ ) without the four above mentioned samples indicates that the data are highly correlated.

The laboratory versus XRF metal concentration data were compared using four statistical methods. Each method has its strengths and weaknesses and favors data within a certain range of data. Larger variations are expected at higher metal concentrations. The accuracy of the statistical method near the anticipated action level should be considered.

The first method is relative percent difference (RPD). Relative percent difference is the difference between the lab and XRF data divided by the average of the two values. This method shows less variability for the larger concentration data because the average (divisor) is higher and the result shows a lower RPD. At lower concentrations, a small variation between the values shows a larger RPD because the average is lower. This method for XRF data evaluation is more specific to whatever range of data is of most interest (usually the "action level") (Graphs 6 and 7).

The second method is standardized residuals from linear regression analysis. The standardized residual is the difference between the lab and the XRF data divided by the standard error for the y estimate (sey) for the linear regression. The standardized residual shows less variability for the lower data because the same sey is used over the entire range of concentrations so the divisor remains constant, and therefore the relatively small variations seen at low metal concentrations show up as small standardized residuals. The larger variations seen at higher metal concentrations, even when the variation is a small percentage of the actual concentration, shows a higher standardized variation (Graphs 5, 6, 7, and 8).

The third method is the coefficient of determination ( $R^2$ ) from linear regression analysis. The coefficient of determination can show the effectiveness of the XRF as a screening tool. The XRF is usually considered adequate when the coefficient of determination is above 0.70. The coefficient of determination is above 0.90 for the comparison of laboratory versus XRF data for both arsenic and lead data in this case, indicating good correlation between laboratory and XRF data (Graphs 1, 2, and 3).

The fourth method is linear regression with 95% confidence bands. This analysis was performed on the data but may be of limited use because the data is not normally distributed over the entire concentration range. The confidence bands for arsenic may be useful in determining the XRF results that are considered "high" when making remedial decisions. The confidence bands may be of more limited use for the lead data, above about 500 mg/Kg, because of the bias toward low lead concentrations in the samples sent for laboratory analysis. The calculation of the confidence bands includes the average laboratory concentration. Because the average concentration is very low, approximately 182 mg/Kg, the confidence bands are very large at higher lead concentrations. Additional data above 500 mg/Kg lead concentration would be expected to make the confidence bands more useful in the higher lead concentration range (Graphs 1, 2, and 3).



## 6.0 SAMPLE RESULTS

A summary of XRF sample results, separated into groups of surface soil samples (0 to 2 inches bgs) and depth soil samples (6 to 10 inches bgs), can be found in Table 1 and Table 2, respectively. A summary of properties sampled for arsenic and lead analysis (XRF and ICP laboratory data) can be found in Table 3. This table includes all properties that were analyzed by XRF or ICP analyses to have arsenic or lead detections within the specified concentration brackets. XRF results from all samples collected can be found in Table 4 of this text. Laboratory confirmation data can be found in Table 5 along with relative percent differences in comparison to associated XRF results. Additionally, a linear regression analysis with coefficient of determination and 95% confidence intervals was plotted for the comparison of XRF/laboratory data for arsenic and lead analysis.

XRF sample results indicated numerous detections of arsenic and lead above the initial analytical target levels of 70 mg/Kg for arsenic and 500 mg/Kg for lead. A total of five samples out of 3,550 samples collected had concentrations of cadmium above the XRF detection limit of 100 mg/Kg. These five samples had XRF concentrations ranging from 100 mg/Kg to 120 mg/Kg. Three of these samples, all having XRF detections at 110 mg/Kg, were sent in for analytical confirmation and resulted in ICP analyses detecting cadmium at 4.3 mg/Kg, 6.4 mg/Kg, and 21.5 mg/Kg. Due to the lack of detections of cadmium in samples, and the fact that the XRF biased cadmium data high, cadmium will not be reported further during this project.

All sample results have been plotted on a base map for the GIS database, indicating the spatial relationship of arsenic and lead detections. Concentrations of arsenic in surface soils and at depth are plotted on Figures 2 and 3, and concentrations of lead in surface soils and at depth are plotted on Figures 3 and 4.

**TABLE 1**  
**Surface Soil\*\* Sample Results Summary**

Arsenic Value Range mg/Kg	Number of Surface Soil Samples with Arsenic in Specified Range	Lead Value Rang mg/Kg	Number of Surface Soil Samples with Lead in Specified Range
<70	2,162	<500	2,368
70 - 250	207 (18*)	500 - 1,000	77
251 - 399	22	1,001 - 1,199	2
401 - 1,000	38	1,200 - 1,500	2
>1,000	7	>1,500	5

\* Indicates an additional number of samples that were undetected within the concentration range because of lead interference

\*\* Indicates the sample was collected from 0 to 2 inches bgs

**TABLE 2**  
**Depth Soil\*\*\* Sample Results Summary**

Arsenic Value Range mg/Kg	Number of Depth Soil Samples with Arsenic in Specified Range	Lead Value Range mg/Kg	Number of Depth Soil Samples with Lead in Specified Range
<70	969	<500	1,050
70 - 250	94 (15*)	500 - 1,000	34
251 - 399	7	1,001 - 1,199	1
400 - 1,000	5 (4*)	1,200 - 1,500	3
>1,000	2	>1,500	8

\* Indicates an additional number of samples that were undetected within the concentration range because of lead interference

\*\*\* Indicates the sample was collected from 6 to 10 inches bgs.

**TABLE 3**  
**Summary of Properties - Arsenic and Lead / Surface and Depth Results Summary**

Arsenic Value Range mg/Kg	Lead Value Range mg/Kg	Number of Properties Meeting Criteria to Left*
≥ 70 and ≤ 399	≥ 500 and ≤ 1,999	248
≥ 400	≥ 2000	46

• Includes substitution of Laboratory data for XRF data where samples were undetected within the concentration range because of lead interference or where laboratory data indicated a higher concentration than the XRF data.

## 7.0 SUMMARY

On March 2, 1998, and from April 14 to April 28, 1998, personnel from START and REAC collected a total of 2,363 surface soil samples (0 to 2 inches below ground surface (bgs)), 1,096 depth soil samples (6 to 10 inches bgs), and 91 field replicates, totaling 3,550 soil samples from a total of 1,152 properties in the neighborhoods of Elyria and Swansea in North Denver, Colorado, averaging approximately 3.1 soil samples per property sampled. All 3,550 soil samples were analyzed with an XRF, 361 of which were sent to a private analytical laboratory for confirmation of XRF results.

A total of 46 properties had arsenic concentrations greater than or equal to 400 mg/Kg and/or lead concentrations greater than or equal to 2,000 mg/Kg. A total of 248 properties had arsenic concentrations ranging from 70 mg/Kg to 399 mg/Kg and/or lead concentrations ranging from 500 mg/Kg to 1,999 mg/Kg.

The need for expanding the project boundaries has arisen as a result of Phase I of field work. Project boundaries for Phase II of field work will move from 38<sup>th</sup> Avenue south to 35<sup>th</sup> Avenue. This area will be bordered on the east by Colorado Boulevard and on the west by the South Platte River. Additionally, residences adjacent to, or proximal to properties that exhibited concentrations of arsenic or lead above the analytical target levels (70 mg/Kg and 500 mg/Kg, respectively) within the Phase I boundaries will potentially be sampled, pending access from the property owner. In addition to sampling the above expanded areas, the CDPHE requested that the EPA sample a small neighborhood located west of I-25, south of I-70, east of Fox Street, and north of 38<sup>th</sup> Avenue. This area, located within the boundaries of Globeville, was not sampled as part of the Asarco Globeville project and is located within one mile of the former Omaha Grant Smelter.

Access for sampling Phase II of the NDRS project is being conducted concurrently with the completion of Phase I. An amendment to the final SAP for the sampling of Phase II will be completed and submitted after the finalization of Phase I.

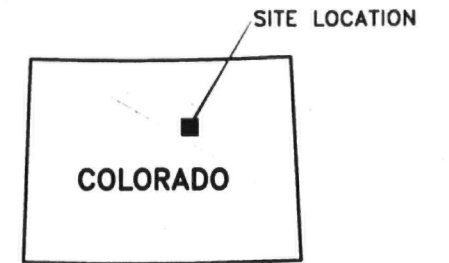
## 8.0 LIST OF REFERENCES

Colorado Department of Public Health and Environment (CDPHE). 1998. XRF and ICP Analytical Data for 25 Soil Samples Collected in the Elyria and Swansea Neighborhoods. Received on January 5, 1998.

Environmental Response Team (ERT). 1995. "Spectrace 9000 Field Portable X-Ray Fluorescence Operating Procedures." January 26, 1995.

URS Operating Services, Inc. (UOS). 1997. "Draft Emergency Response Program (ERP) Generic Quality Assurance Project Plan for the Superfund Technical Assessment and Response Team (START), EPA Region VIII." July 31, 1997.

URS Operating Services (UOS). 1998. Final Sampling and Analysis Plan. March 19, 1998.



— ■ — APPROXIMATE SITE  
LOCATION BOUNDARY



UOS - START  
Job# 75-71203.00

NORTH DENVER RESIDENTIAL SOILS  
DENVER, CO.

## SITE LOCATION MAP

Figure 1

July 1998

**URS**  
OPERATING SVCS.

Figures 2 through 5 are enclosed in pockets following this page.

**TARGET SHEET**  
EPA REGION VIII  
**SUPERFUND DOCUMENT MANAGEMENT SYSTEM**

DOCUMENT NUMBER: 197869

SITE NAME: VASQUEZ BOULEVARD AND I-70

DOCUMENT DATE: 07/06/1998

**DOCUMENT NOT SCANNED**

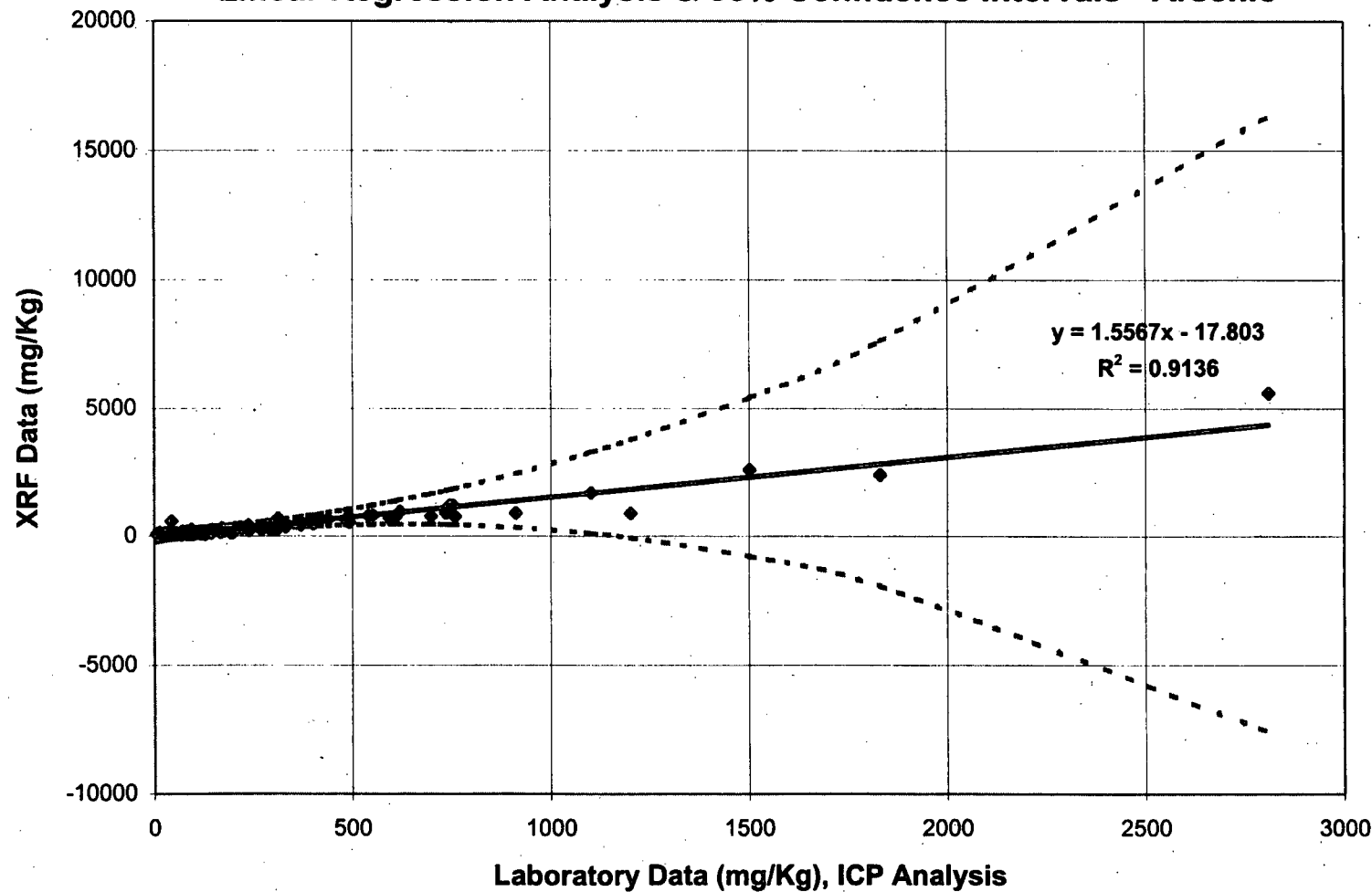
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- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
- ☒ OVERSIZED
- ☐ AUDIO/VISUAL
- ☐ PERMANENTLY BOUND DOCUMENTS
- ☐ POOR LEGIBILITY
- ☐ OTHER
- ☐ NOT AVAILABLE
- ☐ TYPES OF DOCUMENTS NOT TO BE SCANNED  
(Data Packages, Data Validation, Sampling Data, CBI, Chain of Custody)

**DOCUMENT DESCRIPTION:**

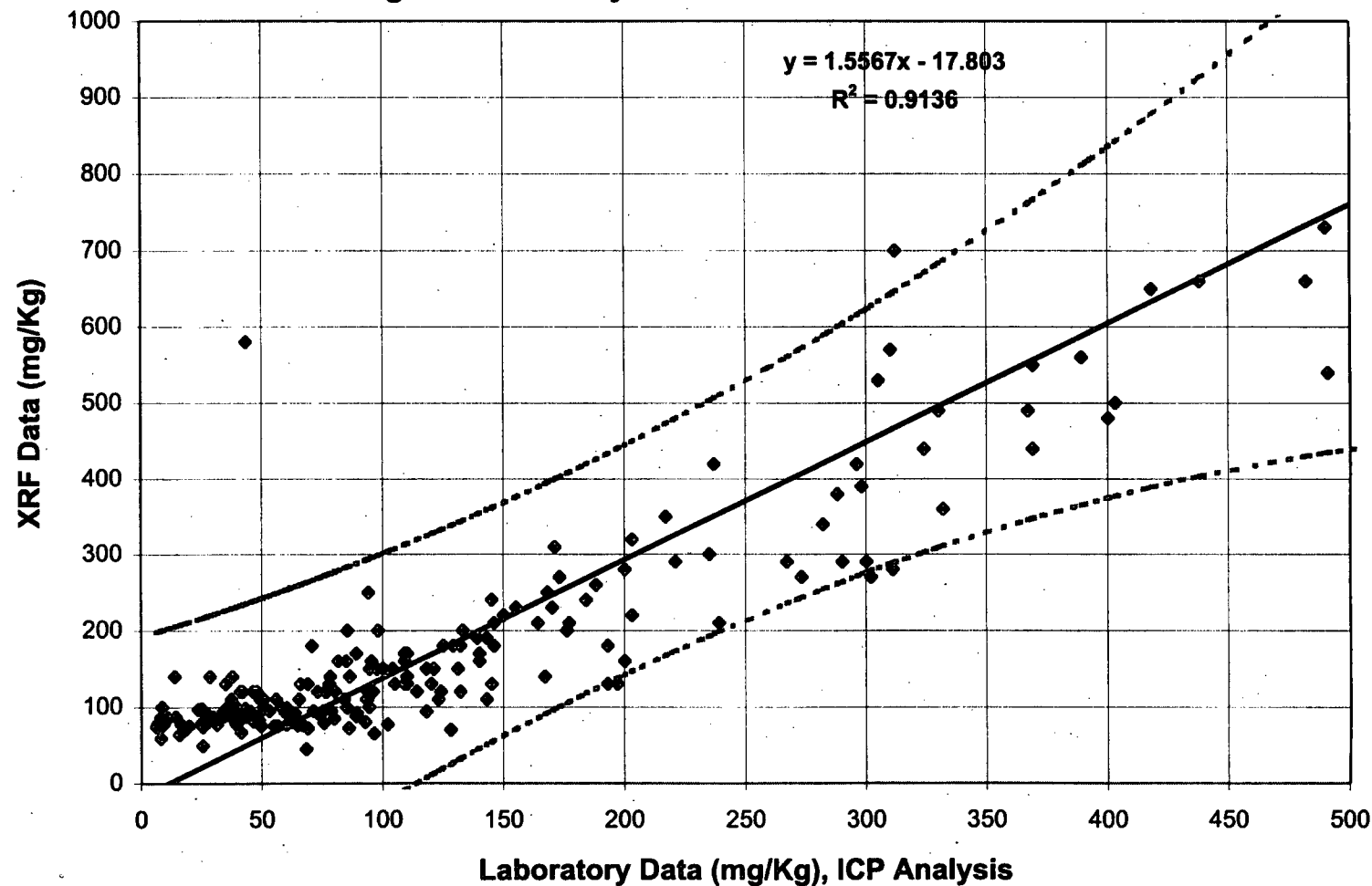
FIGURE 2 SURFACE SOIL ARSENIC CONCENTRATIONS  
FIGURE 3 SUBSURFACE SOIL ARSENIC CONCENTRATIONS  
FIGURE 4 SURFACE SOIL LEAD CONCENTRATIONS  
FIGURE 5 SUBSURFACE SOIL LEAD CONCENTRATIONS

**Graph 1**  
**North Denver Residential Soils**  
**XRF/Laboratory Data**  
**Linear Regression Analysis & 95% Confidence Intervals - Arsenic**

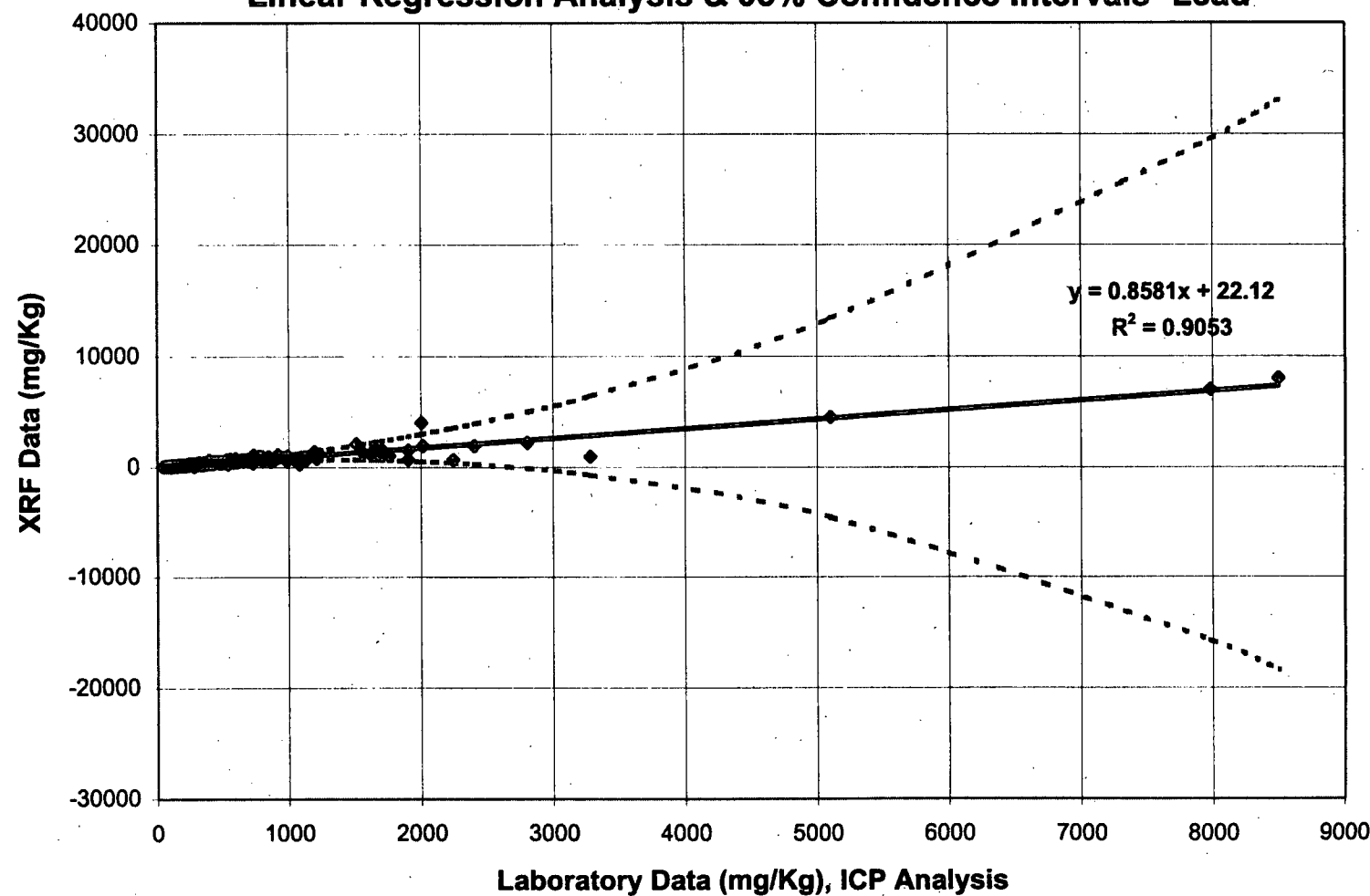




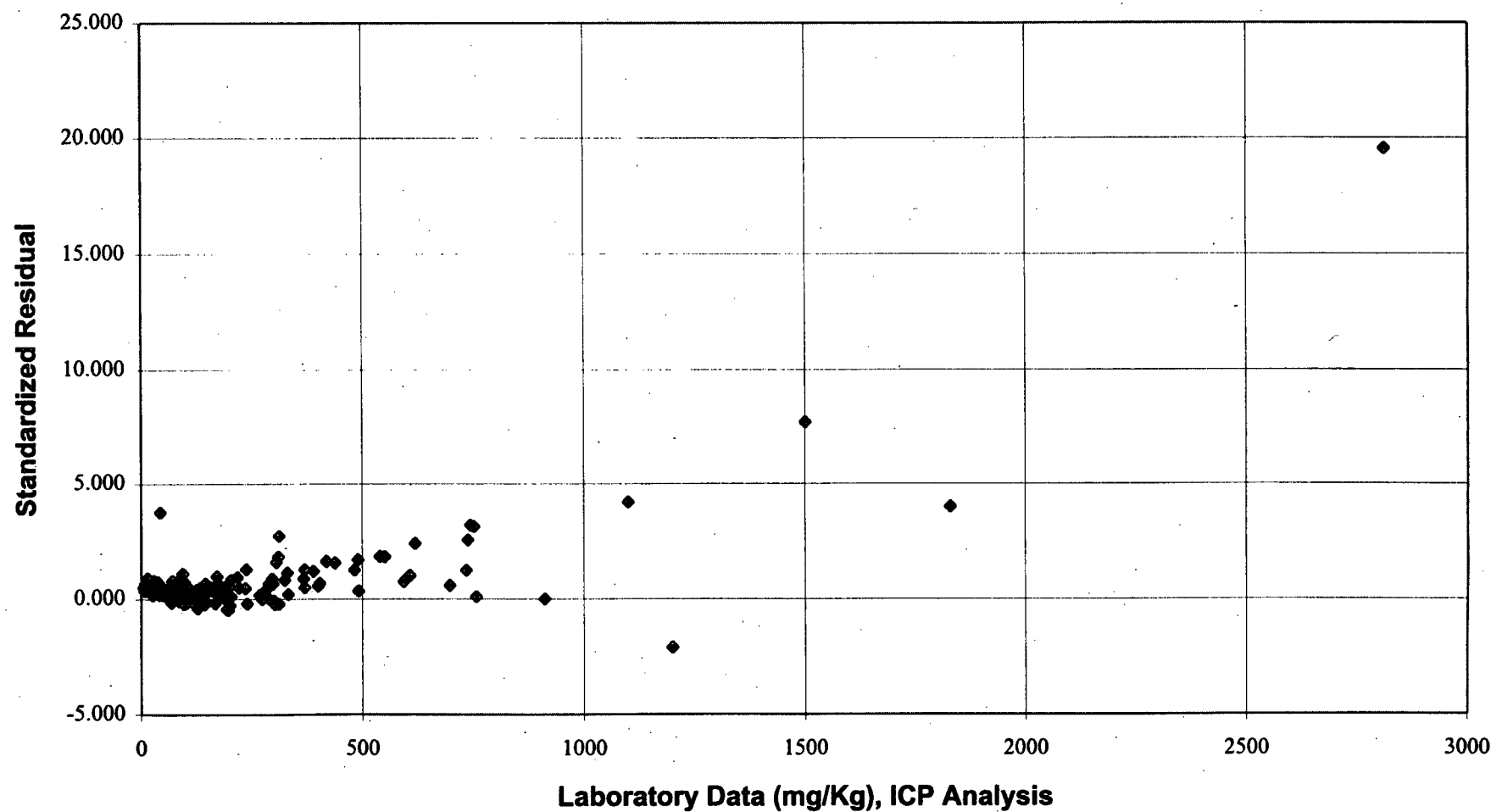
**Graph 2**  
**North Denver Residential Soils**  
**XRF/Laboratory Data**  
**Linear Regression Analysis & 95% Confidence Intervals - Arsenic**



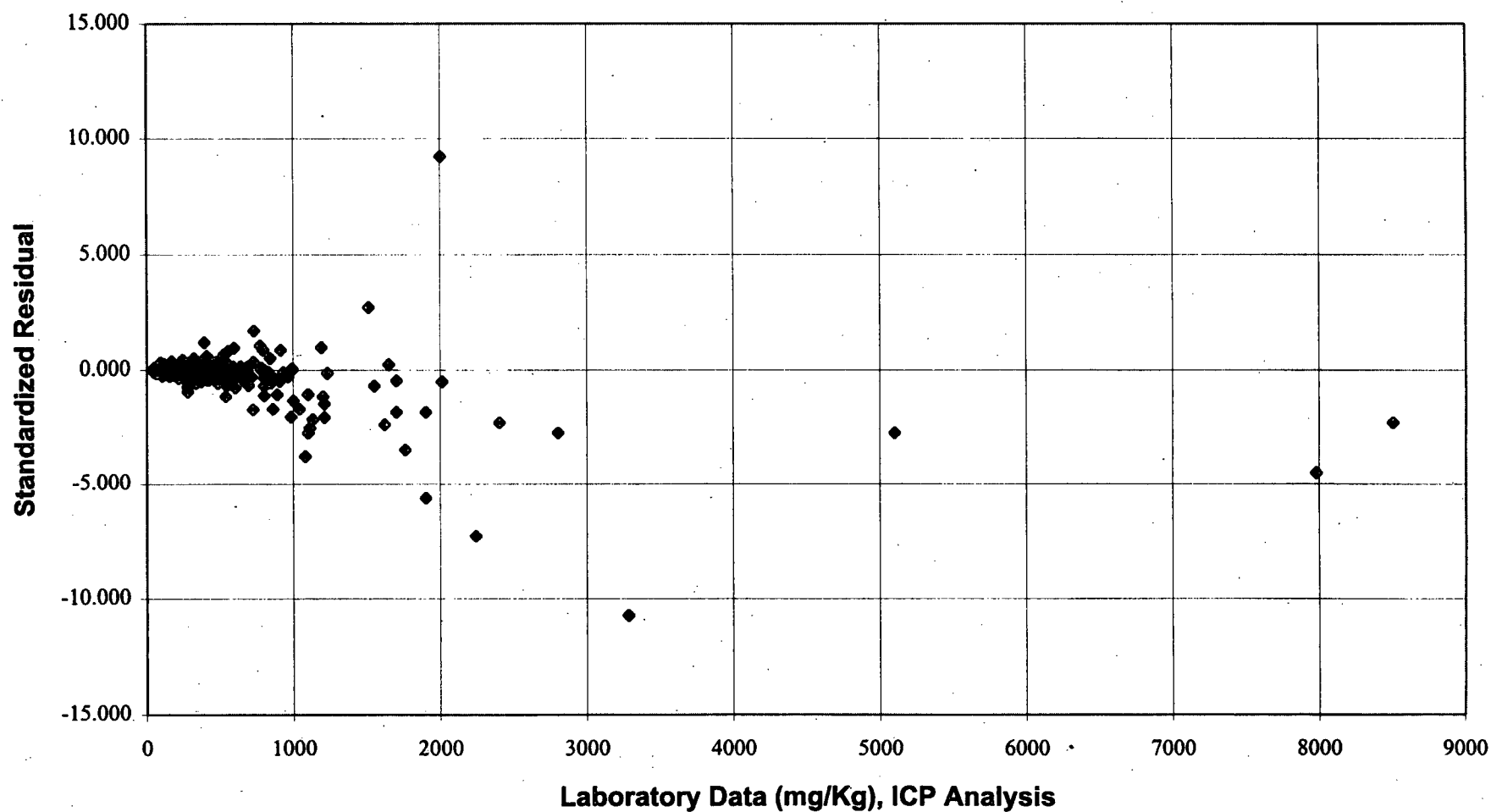
**Graph 3**  
**North Denver Residential Soils**  
**XRF/Laboratory Data**  
**Linear Regression Analysis & 95% Confidence Intervals- Lead**



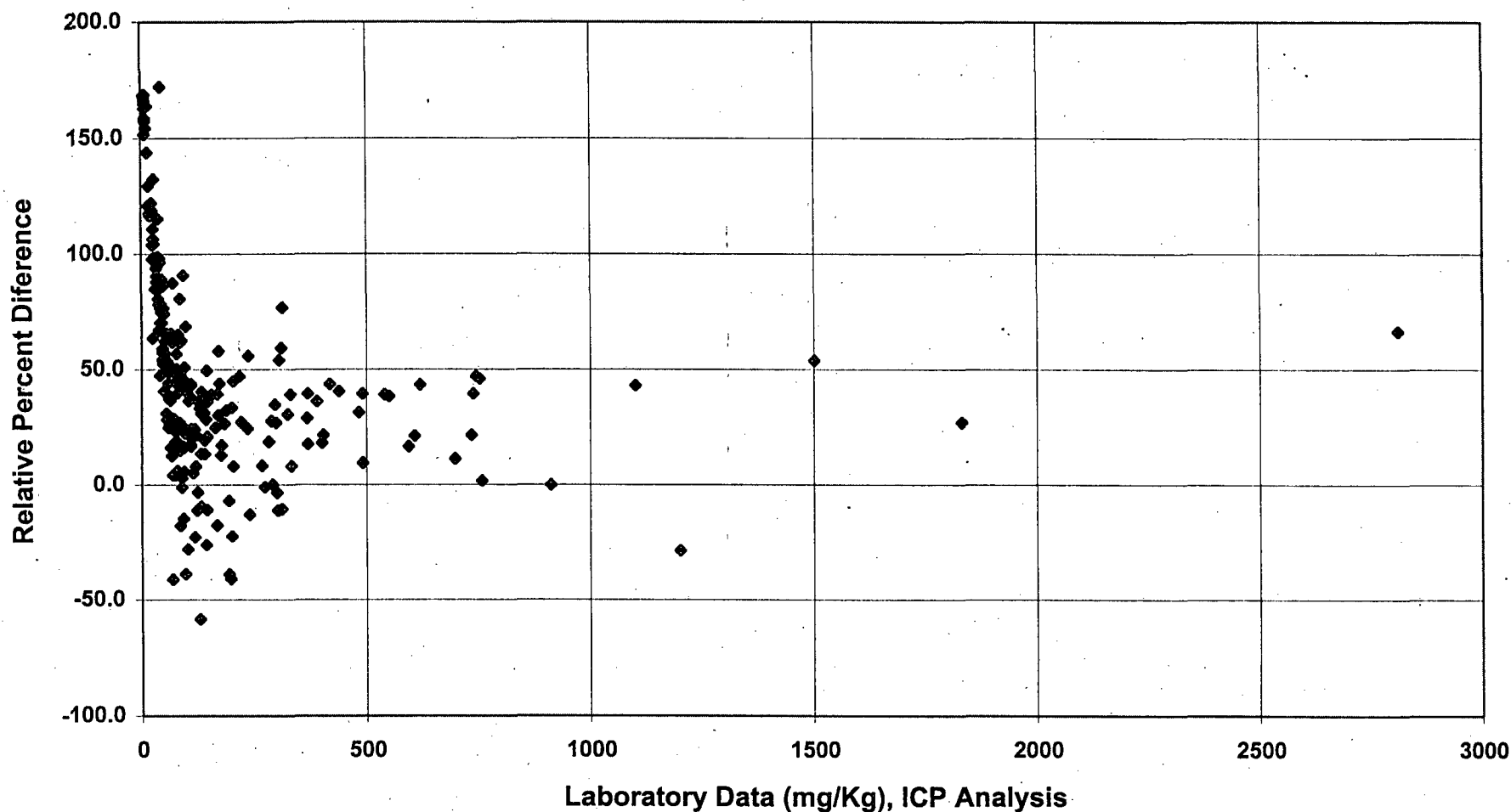
**Graph 4**  
**North Denver Residential Soils**  
**XRF/Laboratory Data - Standardized Residuals - Arsenic**



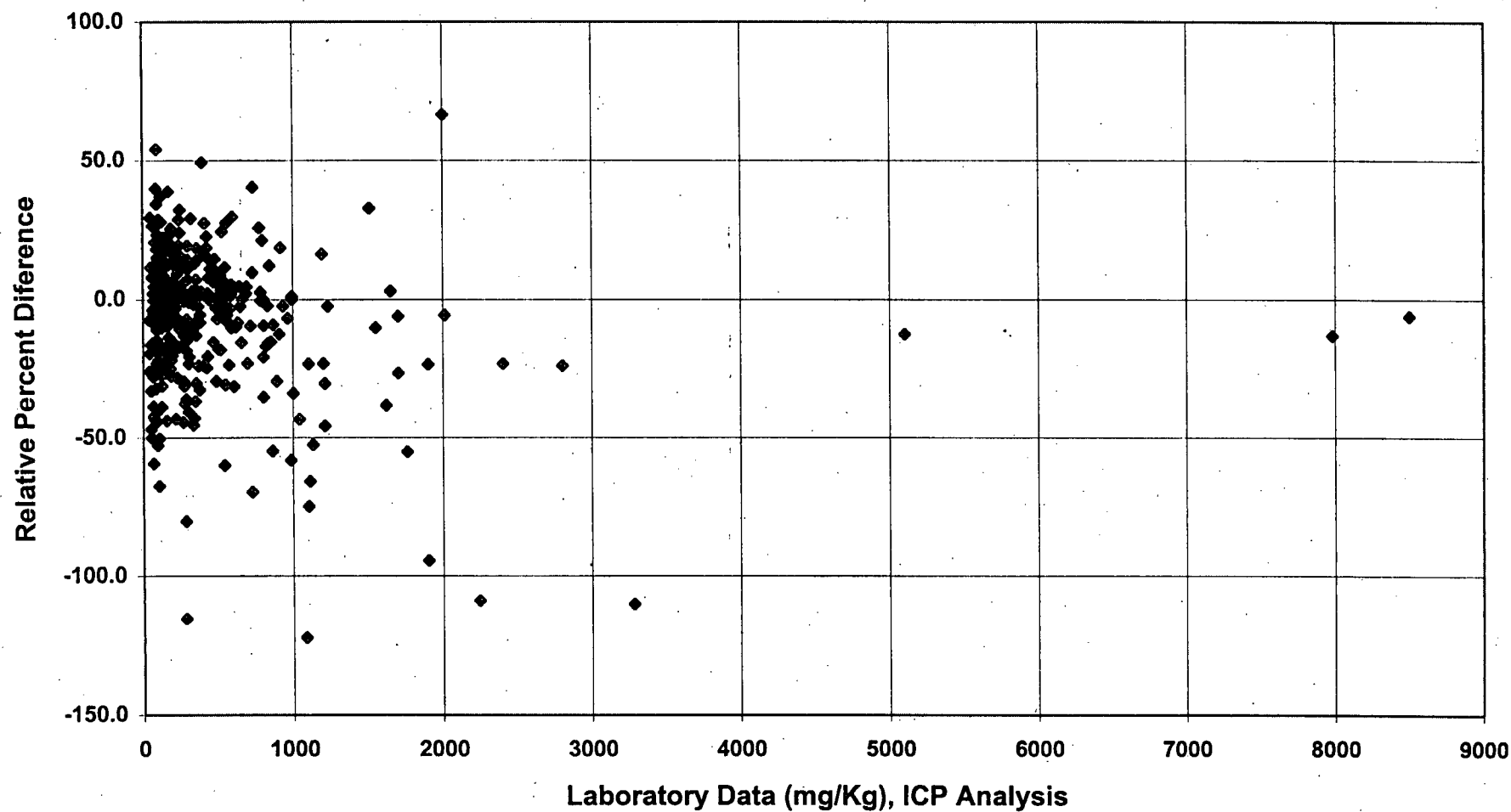
**Graph 5**  
**North Denver Residential Soils**  
**XRF/Laboratory Data - Standardized Residuals - Lead**



**Graph 6**  
**North Denver Residential Soils**  
**XRF/Laboratory Data - Relative Percent Differences - Arsenic**



**Graph 7**  
**North Denver Residential Soils**  
**XRF/Laboratory Data - Relative Percent Differences - Lead**



**TABLE 4**

**North Denver Residential Soils Spectrace 9000 XRF Data**

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D240137	P10	57 U	30 U		V70	44 U	340
	P16	57 U	36 J		V70R	44 U	260
	P20	57 U	61 J		V80	44 U	280
D121338	B10	69 U	690		V86	44 U	140
	B16	44 U	390		V90	44 U	240
	F10	44 U	170		VA0	44 U	240
	S10	44 U	350		VA6	44 U	400
	S20	44 U	180		VB0	44 U	260
D190038	B10	57 U	240	D282345	F10	71 J	140
	B20	57 U	320		S10	57 U	180
	F10	57 U	250		S16	57 U	110
	F16	57 U	290	D330145	B10	57 U	30 U
	F20	60 J	69 J		B16	57 U	30 U
D323038	P10	57 U	47 J		G10	57 U	52 J
	P16	57 U	47 J		P10	57 U	130
	P20	57 U	78 J	D130146	V10	44 U	51 J
D333538	B10	44 U	72 J		V20	44 U	99
	B16	44 U	60 J		V26	44 U	130
	F10	44 U	100		V30	48 J	210
D271740	B10	57 U	120		V40	44 U	77 J
	F10	57 U	88 J		V46	44 U	180
	F16	57 U	100	D261546	F10	44 U	300
D293743	B10	57 U	72 J		F16	44 U	240
	B16	57 U	33 J		S10	44 U	390
	F10	57 U	130	D263046	B10	57 U	210
	S10	57 U	50 J		B16	57 U	80 J
D180144	V18	700 U	7000		F10	57 U	220
	V28	400 U	4000	D282546	B10	57 U	40 J
	V324	800 U	8000		B16	57 U	46 J
D250044	V10	65 J	220		F10	57 U	110
	V20	57 U	270	D190147	B10	44 U	130
	V26	57 U	380		B16	44 U	150
	V30	57 U	170		F10	160	290
	V40	57 U	200	D200047	B10	120 J	260
	V46	57 U	42 J		B16	390	640
	V50	57 U	270		S10	57 U	210
	V60	57 U	230	D220047	B10	57 U	190

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.



**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D220047	B20	57 U	200	D269049	B10	57 U	30 U
	B26	57 U	320		B16	57 U	86 J
	F10	57 U	180		F10	57 U	41 J
D244147	B10	44 U	96	D270150	B10	61 J	54 J
	B16	44 U	74 J		B16	57 U	120
	F10	57 U	100		F10	120 J	210
	F10R	57 U	69 J		G10	57 U	140
D310047	B10	57 U	70 J	D313151	B10	57 U	140
	B16	57 U	46 J		B16	57 U	140
	F10	57 U	61 J		F10	57 U	100
	P10	72 J	36 J	D3835AD	B10	100 J	110
D311047	B10	63 J	100		B16	70 J	76 J
	B16	80 J	130		F10	480	330
	F10	57 U	52 J	D3910AD	B10	67 J	100
D312047	B10	57 U	53 J		B16	50 J	84 J
	B16	57 U	77 J		F10	57 U	79 J
	F10	74 J	110		G10	69 J	56 J
D313047	B10	44 U	140		G10R	57 U	65 J
	B16	44 U	140	D3911AD	B10	57 U	58 J
	F10	44 U	56 J		B16	57 U	68 J
D180548	V10	57 U	30 U		F10	57 U	73 J
	V16	57 U	30 U		G10	57 U	65 J
D261548	V10	57 U	120		S10	57 U	71 J
	V16	57 J	30 U	D3925AD	B10	57 U	100
	V20	57 J	82 J		B16	57 U	73 J
D264548	F10	57 U	77 J		F10	57 U	74 J
	S10	57 U	130	D3932AD	B10	57 U	83 J
	S16	57 U	72 J		B16	57 U	78 J
D265049	V10	44 U	150		F10	57 U	65 J
	V20	44 U	28 U	D3933AD	B10	57 U	69 J
	V26	44 U	28 U		B16	63 J	69 J
	V30	44 U	120		F10	68 J	58 J
	V40	44 U	82 J	D3975AD	B10	44 U	110
	V46	44 U	180		B16	57 U	78 J
	V50	44 U	28 U		F10	44 U	100
	V60	44 U	78 J		F10R	44 U	110
	V66	44 U	89 J		G10	44 U	110

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4026AD	B10	44 U	140		B16	44 U	93 J
	F10	44 U	96		F10	44 U	83 J
	F16	44 U	99	D4301AD	V10	44 U	110
D4036AD	F10	44 U	54 J		V16	44 U	28 U
	G10	44 U	86 J		V20	44 U	160
	S10	44 U	62 J	D4321AD	B10	44 U	200
	V10	44 U	46 J		B16	44 U	200
	V16	44 U	63 J		F10	44 U	95 J
D4100AD	F10	44 U	55 J	D4325AD	B10	68 J	230
	F16	44 U	70 J		B16	44 U	290
	S10	44 U	48 J		F10	44 U	88 J
D4114AD	B10	44 U	95		F10R	44 U	65 J
	B16	44 U	96	D4330AD	B10	57 U	340
	F10	44 U	130		B16	44 U	310
D4115AD	B10	44 U	170		F10	44 U	220
	B16	44 U	170	D4335AD	B10	57 U	130
	F10	44 U	170		B16	57 U	130
D4120AD	B10	44 U	88 J		F10	57 U	55 J
	F10	44 U	130	D4347AD	B10	57 U	73 J
	F10R	44 U	150		B16	57 U	74 J
	F16	46 J	75 J		F10	57 U	63 J
D4121AD	B10	44 U	240	D4354AD	V10	44 U	130
	F10	44 U	140		V16	44 U	28 U
	F16	44 U	130		V20	44 U	120
D4130AD	B10	44 U	100	D4385AD	V10	44 U	37 J
	B16	44 U	98		V20	44 U	31 J
	F10	44 U	52 J	D4410AD	B10	57 U	36 J
D4131AD	B10	44 U	99		B16	57 U	30 U
	B16	44 U	58 J		F10	57 U	59 J
	F10	44 U	87 J	D4420AD	B10	57 U	30 U
D4132AD	B10	44 U	58 J		B16	57 U	30 U
	F10	44 U	52 J		F10	57 U	42 J
	F16	44 U	28 U	D4430AD	B10	57 U	57 J
D4150AD	B10	44 U	59 J		B16	57 U	32 J
	B16	44 U	57 J		F10	57 U	60 J
	F10	290	320	D4434AD	F10	57 U	60 J
D4161AD	B10	44 U	68 J		F16	57 U	58 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4434AD	S10	57 U	74 J		F10	73 U	730
	S10R	57 U	95 J		S10	57 U	96 J
D4440AD	B10	57 U	110	D4900AD	B10	44 U	58 J
	B16	57 U	87 J		B16	44 U	28 U
	F10	57 U	46 J		F10	57 U	39 J
D4443AD	B10	57 U	82 J	D4903AD	B10	44 U	47 J
	B16	57 U	92 J		B16	44 U	29 J
	F10	57 U	83 J		F10	44 U	71 J
D4450AD	B10	88 J	52 J	D4919AD	B10	44 U	130
	B16	57 U	120		B16	44 U	120
	F10	57 U	110		F10	44 U	80 J
D4460AD	B10	57 U	74 J		G10	44 U	55 J
	B16	57 U	78 J	D4926AD	B10	44 U	66 J
	F10	57 U	75 J		B16	44 U	83 J
D4800AD	B10	57 U	130		F10	44 U	100
	B16	57 U	100	D4927AD	B10	51 J	170
	F10	70 J	83 J		B16	44 U	65 J
D4811AD	B10	44 U	110		F10	44 U	49 J
	B16	44 U	75 J	D4928AD	B10	44 U	87 J
	F10	44 U	170		B16	44 U	28 U
D4820AD	B10	57 U	140		F10	44 U	100
	B16	57 U	94 J		G10	44 U	28 U
	F10	57 U	110	D4929AD	B10	44 U	59 J
	G10	57 U	97 J		B16	44 U	59 J
D4831AD	B10	44 U	59 J		F10	44 U	100
	B16	44 U	52 J	D4930AD	B10	44 U	88 J
	F10	94 J	290		B16	52 J	58 J
	G10	44 U	170		F10	44 U	120
D4841AD	B10	57 U	30 U	D4935AD	B10	57 J	92 J
	B16	74 J	30 U		B16	130 J	59 J
	F10	44 U	100		F10	500	220
	F10R	44 U	94 J		F10R	430	270
D4850AD	B10	370	350		G10	44 U	56 J
	B16	94 J	46 J	D4940AD	B10	44 U	52 J
	F10	2600	530		B16	44 U	46 J
D4860AD	B10	98 J	67 J		F10	44 U	62 J
	B16	80 J	200	D4949AD	B10	44 U	47 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4949AD	B16	44 U	34 J		P16	79 J	28 U
	F10	44 U	68 J	D5067AD	F10	140 J	150
D4958AD	B10	44 U	84 J		P10	68 J	100
	B16	44 U	59 J		P16	44 U	37 J
	F10	44 U	66 J	D5080AD	B10	44 U	83 J
	S10	44 U	40 J		B16	44 U	57 J
	S10R	44 U	79 J		F10	44 U	110
D4959AD	B10	44 U	80 J		G10	57 U	42 J
	B16	44 U	49 J	D5083AD	B10	44 U	97
	F10	750	220		B16	44 J	46 J
D4972AD	B10	57 U	30 U		F10	66 J	63 J
	B16	57 U	62 J		G10	44 U	32 J
	F10	57 U	30 U	D5091AD	B10	44 U	210
	G10	57 U	30 U		B16	57 U	100
D4979AD	F10	110 J	50 J		F10	44 U	110
	G10	44 U	58 J	D3600AR	V10	44 U	200
	P10	57 U	130		V20	44 U	68 J
	P16	60 J	32 J		V26	44 U	70 J
D4990AD	B10	81 J	160	D3801AR	V10	44 U	320
	B16	85 J	100		V20	44 U	200
	F10	160 J	320		V26	44 U	140
	G10	57 U	99		V30	44 U	65 J
D4995AD	B10	57 U	37 J		V40	44 U	73 J
	B16	57 U	30 U		V46	44 U	76 J
	F10	60 J	85 J		V50	44 U	84 J
D5001AD	B10	59 J	41 J		V60	44 U	57 J
	B16	87 J	33 J		V66	44 U	56 J
	F10	140 J	52 J	D4611BA	B10	72 U	720
	G10	44 U	45 J		B16	140 U	1400
D5020AD	B10	170 J	150		F10	78 U	780
	B16	150	70 J	D4615BA	B10	91 U	910
	F10	560	310		B16	81 U	810
	G10	120 J	44 J		F10	58 U	580
	G10R	44 U	68 J	D4639BA	S10	57 U	380
D5030AD	B10	44 U	62 J		S10R	57 U	470
	F10	490	340		S16	57 U	290
	P10	400	230	D4645BA	B10	57 U	540

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4645BA	B16	64 J	500		B16	56 U	560
	F10	57 U	560		F10	44 U	270
D4655BA	V10	57 U	37 J	D4731BR	V10	44 U	40 J
	V20	57 U	55 J		V20	44 U	28 U
	V30	57 U	32 J		V26	47 U	470
	V36	57 U	92 J	D4251CB	B10	44 U	310
	V40	57 U	34 J		B16	44 U	340
	V46	57 U	170		F10	44 U	300
D4660BA	B10	80 U	800	D4301CB	B10	57 U	45 J
	B16	57 U	470		B16	57 U	160
	S10	57 U	410		F10	57 U	280
	S20	57 U	290	D4309CB	F10	57 U	500
D4712BA	B10	73 U	730		F16	62 U	620
	B16	57 U	540	D4323CB	B10	57 U	150
	F10	57 U	330		B16	57 U	150
D4748BA	V10	44 U	59 J		F10	57 U	240
	V16	44 U	200	D4353CB	B10	57 U	450
	V20	57 U	75 J		B16	66 U	660
D4764BA	B10	57 U	460		F10	57 U	440
	F10	78 J	240	D4395CB	B10	57 U	550
	F16	44 U	240		B16	57 U	480
D4772BA	B10	44 U	280		F10	57 U	370
	B16	44 U	260	D4401CB	B10	44 U	100
	F10	44 U	170		B16	44 U	240
D4778BA	V10	44 U	36 J		F10	44 U	180
	V16	44 U	130	D4428CB	B10	57 U	30 U
	V20	44 U	28 U		B16	57 U	74 J
D4501BR	V11	44 U	45 J		F10	57 U	160
	V16	48 U	480	D4430CB	F10	57 U	130
	V21	44 U	140		F16	44 U	44 J
D4656BR	B10	44 U	230	D4432CB	F10	57 U	85 J
	B16	44 U	200		F16	57 U	31 J
	F10	44 U	330	D4436CB	B10	44 U	340
D4660BR	B10	44 U	250		B16	44 U	210
	B16	44 U	220		F10	44 U	140
	F10	44 U	330	D4445CB	F10	72 J	250
D4717BR	B10	55 U	550		F10R	67 J	250

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4445CB	S10	44 U	350	D4631CB	B10	57 U	190
	S16	44 U	130		B16	57 U	140
D4451CB	B10	44 U	140		F10	57 U	130
	B16	44 U	200	D4637CB	B10	57 U	91 J
	F10	44 U	160		B16	57 U	260
D4459CB	B10	57 U	320		F10	57 U	170
	B16	57 U	430	D4643CB	F10	57 U	210
	F10	57 U	210		P10	57 U	100
D4460CB	G10	57 U	260		P16	57 U	130
	G20	57 U	98 J	D4650CB	P10	57 U	110
	S10	57 U	210		P16	57 U	84 J
	S16	57 U	240		P20	57 U	30 U
D4515CB	B10	110 J	440		P20R	57 U	52 J
	B16	70 J	370	D4651CB	B10	57 U	81 J
	F10	57 U	270		B16	57 U	69 J
	F10R	130 J	230		F10	57 U	160
D4519CB	B10	57 U	30 U	D4661CB	B10	57 U	340
	B16	57 U	190		B16	57 U	310
	F10	57 U	160		F10	57 U	410
D4527CB	B10	44 U	270	D4669CB	B10	57 U	70 J
	B16	57 U	360		B16	57 U	76 J
D4529CB	B10	44 U	210		F10	57 U	3920 L
	B16	44 U	220		F10R	57 U	200
	F10	44 U	180	D4675CB	B10	57 U	200
D4531CB	B10	44 U	230		B16	70 J	200
	B16	44 U	250		F10	65 U	650
	F10	44 U	250	D4679CB	B10	220	430
D4535CB	B10	44 U	270		B16	120 J	110
	B16	210	390		G10	57 U	130
	F10	150	470		P10	110 J	200
D4539CB	B10	62 J	180	D4700CB	B10	57 U	71 J
	B16	44 U	430		B16	57 U	77 J
	F10	300	450		F10	57 U	140
D4543CB	B10	63 J	280	D4709CB	B10	57 U	110
	B16	57 U	390		B16	57 U	150
	F10	61 J	220		G10	57 U	30 U
	F10R	57 U	290	D4710CB	B10	57 U	51 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4710CB	B16	57 U	65 J	D4790CB	F10	44 U	230
	F10	57 U	170		P10	67 J	170
D4715CB	B10	44 U	79 J		P16	48 J	200
	F10	77 J	260	D4795CB	B10	44 U	170
	F16	44 U	230		B16	44 U	210
	G10	44 U	160		F10	44 U	56 J
D4720CB	B10	57 U	61 J	D4800CB	V10	44 U	110
	B16	57 U	80 J		V20	44 U	170
D4740CB	B10	44 U	200		V26	44 U	28 U
	B10R	57 U	65 J		V30	44 U	420
	F10	44 U	310	D3824CK	B10	44 U	150
	F16	44 U	110		B16	44 U	130
D4741CB	B10	44 U	100		F10	44 U	87 J
	P10	44 U	220	D3825CK	B10	44 U	100
	P16	44 U	150		B16	44 U	61 J
D4747CB	B10	44 U	210		F10	44 U	95 J
	B16	44 U	140		F10R	44 U	140
	P10	44 U	110	D3848CK	B10	44 U	120
D4763CB	F10	44 U	230		B16	44 U	93 J
	F16	44 U	170		F10	44 U	130
	F20	120 J	140	D3854CK	F10	44 U	130
D4765CB	F10	44 U	130		P10	44 U	140
	S10	44 U	140		P16	44 U	180
	S16	44 U	130	D3855CK	B10	98 J	120
D4770CB	B10	44 U	170		B16	55 J	56 J
	F10	44 U	250		F10	44 U	80 J
	F16	340	560		G10	48 J	62 J
D4780CB	B10	290	580		G10R	44 U	60 J
	F10	44 U	250	D3858CK	F10	44 U	260
	F16	160	220		F10R	44 U	280
D4781CB	B10	44 U	53 J		P10	44 U	200
	B16	44 U	97		P16	44 U	270
	F10	44 U	140		S10	44 U	200
	F10R	44 U	160	D3866CK	F10	44 U	84 J
D4785CB	B10	44 U	58 J		S10	44 U	200
	B16	44 U	55 J		S16	44 U	260
	F10	44 U	150	D3883CK	B10	44 U	68 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3883CK	B16	44 U	68 J	D4125CK	B10	44 U	72 J
	F10	44 U	60 J		B16	44 U	47 J
	G10	44 U	65 J		F10	44 U	74 J
D3901CK	B10	44 U	80 J	D4135CK	B10	44 U	100
	B16	44 U	78 J		B16	44 U	71 J
	F10	45 J	47 J		F10	44 U	140
D3909CK	B10	44 U	170	D4300CK	B10	57 U	93 J
	B16	44 U	150		B16	57 U	110
	F10	44 U	240		F10	57 U	110
D3925CK	B10	44 U	55 J		S10	57 U	170
	B16	44 U	190		S20	57 U	130
	F10	44 U	120	D4400CK	B10	44 U	71 J
D4033CK	B10	44 U	410		F10	44 U	60 J
	B16	44 U	80 J		F16	44 U	70 J
	F10	44 U	52 J	D4430CK	F10	170 J	90 J
D4035CK	B10	44 U	85 J		F16	98 J	63 J
	B16	44 U	84 J	D4461CK	F10	57 U	60 J
	F10	44 U	100		P10	57 U	56 J
	F10R	44 U	120		P16	57 U	69 J
D4045CK	B10	44 U	66 J	D4480CK	B10	44 U	140
	B16	44 U	41 J		B16	44 U	97
	F10	44 U	73 J		F10	44 U	61 J
D4053CK	B10	44 U	78 J	D4500CK	F10	57 U	150
	B16	44 U	91 J		S10	57 U	77 J
	F10	44 U	40 J		S16	57 U	66 J
D4060CK	B10	90 J	160	D4511CK	F10	57 U	97 J
	B16	180	190		F10R	57 U	53 J
	F10	91 J	160		F16	57 U	38 J
D4070CK	B10	44 U	47 J		F20	57 U	75 J
	B16	44 U	58 J	D4530CK	B10	57 U	97 J
	F10	77 J	160		B16	57 U	120
D4080CK	B10	44 U	80 J		S10	57 U	64 J
	B16	44 U	46 J		V10	57 U	89 J
	F10	44 U	67 J		V20	57 U	58 J
D4115CK	B10	44 U	33 J	D4839CK	B10	57 U	89 J
	B16	44 U	31 J		B16	57 U	60 J
	F10	44 U	54 J		F10	57 U	170

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4849CK	B10	57 U	160		F10	44 U	220
	B16	57 U	55 J		F16	46 J	270
	F10	57 U	270	D4639CL	F10	44 U	250
D4859CK	B10	57 U	35 J		F16	44 U	290
	B16	57 U	30 U		S10	44 U	280
	F10	57 U	110	D4644CL	B10	44 U	280
D4901CK	B10	57 U	86 J		B16	44 U	360
	B10R	57 U	63 J		S10	44 U	150
	B16	57 U	77 J	D4705CL	B10	44 U	370
	F10	57 U	120		B16	44 U	400
D4929CK	B10	57 U	55 J		F10	44 U	260
	B16	57 U	30 J	D4709CL	B10	44 U	220
	F10	57 U	70 J		B16	44 U	140
D4935CK	B10	63 J	44 J		F10	44 U	220
	B16	44 U	29 J	D4714CL	B10	44 U	240
	F10	57 U	65 J		B16	44 U	200
D4941CK	B10	44 U	93 J		F10	44 U	230
	B16	44 U	70 J	D4717CL	F10	44 U	270
	F10	44 U	65 J		P10	44 U	270
	G10	44 U	58 J		P16	44 U	140
D4949CK	B10	44 U	57 J		P20	44 U	270
	B16	44 U	57 J	D4720CL	B10	79 J	270
	F10	44 U	83 J		B16	44 U	400
D4359CL	B10	44 U	250		F10	44 U	260
	B16	44 U	200	D4735CL	B10	44 U	350
	F10	44 U	290		F10	44 U	310
D4618CL	B10	44 U	240		P10	44 U	260
	B16	44 U	340		P16	44 U	220
	F10	44 U	110	D4760CL	B10	44 U	28 U
	F10R	44 U	130		B16	44 U	28 U
D4619CL	B10	44 U	260		F10	44 U	56 J
	B16	44 U	220		F10R	44 U	52 J
	F10	44 U	180	D4765CL	B10	120 J	180
D4620CL	F10	44 U	360		B16	170 J	120
	P10	44 U	370		F10	110 J	66 J
	P16	44 U	330		F10R	57 U	110
D4636CL	B10	44 U	170	D4767CL	B10	57 U	220

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4767CL	B16	44 U	180	D3831CO	B10	44 U	120
	F10	44 U	180		B16	44 U	120
D4770CL	B10	44 U	270		F10	44 U	60 J
	B16	44 U	230		P10	44 U	93 J
	F10	50 U	500	D3841CO	B10	44 U	40 J
D4782CL	B10	44 U	390		B16	44 U	28 U
	B16	44 U	340		F10	44 U	54 J
	F10	53 U	530	D3851CO	B10	44 U	110
D4783CL	F10	44 U	160		B16	44 U	63 J
	F20	44 U	260		F10	44 U	49 J
	F26	44 U	240	D3855CO	B10	44 U	55 J
D4784CL	F10	44 U	400		B16	44 U	82 J
	F16	44 U	350		F10	44 U	30 J
	F20	44 U	410	D3861CO	B10	44 U	120
D4785CL	F10	280	440		B16	44 U	110
	S10	44 U	210		F10	44 U	180
	S16	44 U	170	D3881CO	B10	44 U	43 J
D4790CL	B10	44 U	240		B16	44 U	56 J
	B16	44 U	270		F10	44 U	33 J
	F10	44 U	220	D3891CO	B10	44 U	99
D4793CL	B10	44 U	350		B16	44 U	28 U
	F10	44 U	220		F10	44 U	28 U
	P10	44 U	270	D3911CO	B10	44 U	46 J
	P16	44 U	390		B16	44 U	37 J
D4794CL	B10	44 U	96		F10	44 U	60 J
	B16	46 U	460	D3921CO	B10	150	59 J
	F10	68 U	680		B16	76 J	28 U
	F10R	44 U	410		F10	44 U	120
D3801CO	B10	44 U	39 J	D4028CY	B10	44 U	180
	B16	44 U	28 U		F10	44 U	250
	F10	44 U	58 J		F16	44 U	420
	V10	44 U	86 J	D4052CY	B10	44 U	410
	V20	44 U	63 J		F10	61 U	610
	V26	44 U	65 J		F16	46 U	460
D3811CO	B10	44 U	60 J	D4102CY	B10	44 U	130
	B16	44 U	56 J		F10	44 U	200
	F10	44 U	150		F16	44 U	190

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4106CY	B10	44 U	200	D4338CY	B10	57 U	160
	F10	44 U	100		B16	57 U	170
	F16	44 U	90 J		F10	57 U	130
D4108CY	B10	44 U	230	D4343CY	F10	110 J	310
	F10	44 U	150		P10	57 U	230
	F16	44 U	140		P16	79 J	190
D4112CY	B10	44 U	270	D4375CY	F10	190	240
	F10	44 U	130		S10	390	510
	F16	44 U	84 J		S16	190	210
D4126CY	B10	44 U	270	D4400CY	B10	64 J	53 J
	F10	44 U	230		B16	57 U	30 U
	F16	44 U	210		F10	97 J	57 J
D4142CY	B10	44 U	80 J	D4401CY	V10	44 U	200
	F10	44 U	67 J		V20	44 U	190
	F16	44 U	83 J		V26	44 U	190
D4162CY	B10	65 J	59 J		V30	44 U	130
	F10	89 J	170		V40	44 U	170
	F16	94 J	86 J		V46	44 U	150
D4254CY	B10	44 U	130		V50	44 U	28 U
	S10	44 U	100		V60	44 U	210
	S16	44 U	110		V66	44 U	240
D4301CY	S10	44 U	130	D4430CY	F10	57 U	170
	S16	44 U	130		P10	57 U	230
D4313CY	B10	44 U	230		P16	65 J	190
	B16	44 U	190	D4434CY	B10	57 U	200
	F10	44 U	210		B16	57 U	210
	S10	44 U	120		F10	57 U	120
D4325CY	F10	100 J	180	D4442CY	F10	57 U	210
	P10	88 J	340		S10	57 U	94 J
	P16	71 J	87 J		S16	57 U	140
D4328CY	F10	180 J	270	D4444CY	F10	57 U	250
	F10R	180 J	260		S10	57 U	110
	S10	140 J	190		S16	57 U	95 J
	S16	180 J	300	D4502CY	F10	57 U	93 J
D4336CY	B10	57 U	73 J		P10	57 U	190
	B16	57 U	160		P16	57 U	140
	S10	57 J	110	D4507CY	B10	63 J	310

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4507CY	B16	65 J	180		B16	44 U	130
	F10	63 U	630		F10	45 J	150
D4512CY	F10	79 J	120	D4670CY	B10	44 U	100
	S10	210	290		B16	44 U	110
	S16	79 J	150		F10	44 U	280
D4517CY	B10	57 U	200	D4671CY	B10	57 U	120
	B16	57 U	150		B16	57 U	160
	F10	65 J	230		F10	57 U	130
D4530CY	F10	57 U	30 U	D4681CY	B10	57 U	69 J
	F10R	57 U	30 U		B16	57 U	30 U
	F16	57 U	240		F10	57 U	96 J
D4533CY	B10	57 U	200	D4685CY	B10	57 U	59 J
	B16	57 U	190		B16	57 U	92 J
	F10	83 J	240		F10	57 U	120
D4543CY	F10	57 U	360	D4690CY	B10	510	790
	P10	57 U	360		B16	420	510
	P16	57 U	280		F10	5600	2100
D4601CY	B10	57 U	240	D4691CY	B10	44 U	33 J
	B16	57 U	250		B16	44 U	39 J
	F10	57 U	300		F10	57 U	110
D4620CY	B10	57 U	58 J	D4700CY	B10	150	440
	B16	57 U	48 J		B16	44 U	96
	F10	57 U	87 J		F10	44 U	170
D4641CY	B10	57 U	30 U		P10	44 U	320
	B16	57 U	30 U	D4701CY	B10	44 U	190
	F10	490	550		B16	44 U	130
D4650CY	B10	57 U	160		F10	44 U	240
	B16	57 U	140	D4705CY	B10	44 U	97
	F10	140 J	170		B16	44 U	84 J
D4651CY	B10	210	150		F10	170	80 J
	B16	140 J	36 J	D4710CY	B10	44 U	130
	F10	140 J	100		B16	44 U	140
D4661CY	B10	44 U	28 U		F10	44 U	150
	B16	44 U	79 J	D4720CY	B10	44 U	28 U
	F10	100 J	130		B16	44 U	28 U
	G10	57 U	110		F10	44 U	110
D4664CY	B10	44 U	120	D4725CY	B10	87 J	180

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4725CY	B16	66 J	130		B16	57 U	160
	F10	190	220		B20	530	480
D4729CY	B10	44 U	56 J		F10	800	480
	B16	44 U	65 J	D4811CY	B10	200	430
	F10	44 U	110		B16	190	390
D4735CY	B10	44 U	130		F10	68 J	300
	B16	44 U	100	D4815CY	B10	57 U	140
	F10	44 U	260		B16	57 U	160
D4746CY	B10	130 J	120		F10	57 U	380
	B16	120 J	130	D4820CY	B10	44 U	120
	F10	180	82 J		B16	44 U	200
D4751CY	B10	44 U	260		F10	44 U	120
	B16	54 J	90 J	D4831CY	B10	57 U	33 J
	F10	44 U	330		B16	57 U	38 J
D4755CY	B10	44 U	110		F10	57 U	30 U
	B16	44 U	130	D4841CY	B10	44 U	120
	F10	44 U	140		B16	44 U	140
	F10R	47 J	150		F10	57 U	140
D4780CY	B10	65 J	560	D4850CY	B10	350	340
	B16	46 J	55 J		B16	110 J	180
	F10	44 U	420		F10	380	360
D4786CY	B10	57 U	110	D4864CY	B10	57 U	46 J
	B16	57 U	170		B16	57 U	34 J
	F10	57 U	61 J		F10	57 U	160
D4790CY	B10	57 U	92 J		G10	57 U	140
	B16	57 U	120	D4900CY	B10	44 U	77 J
	F10	57 U	91 J		B16	44 U	69 J
D4795CY	B10	57 U	130		F10	44 U	100
	B16	57 U	150	D4901CY	B10	44 U	110
	F10	57 U	150		B16	44 U	91 J
D4803CY	B10	44 U	120		F10	61 J	90 J
	B16	44 U	91 J	D4904CY	B10	44 U	34 J
	F10	44 U	100		B16	44 U	51 J
D4807CY	B10	57 U	160		F10	44 U	96
	B16	57 U	150	D4910CY	B10	44 U	82 J
	F10	44 U	180		B16	57 U	57 J
D4809CY	B10	57 U	150		F10	44 U	65 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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TABLE 4

Page 14 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4914CY	B10	44 U	66 J		F10	44 U	120
	B16	63 J	45 J	D4977CY	B10	57 U	49 J
	F10	57 U	130		B16	57 U	110
D4919CY	B10	57 U	320		F10	44 U	120
	B16	68 J	120	D3515DE	B10	44 U	190
	F10	57 U	180		B16	44 U	160
D4921CY	B10	57 U	89 J		F10	44 U	210
	B16	57 U	68 J	D3527DE	B10	310	370
	F10	81 J	170		B16	110 J	290
D4927CY	B10	57 U	55 J		F10	44 U	180
	B16	57 U	98 J	D3638DE	F10	44 U	170
	F10	57 U	100		F16	44 U	28 U
D4931CY	B10	57 U	110	D3660DE	B10	44 U	230
	B16	44 U	120		B16	44 U	290
	F10	57 U	210		F10	44 U	200
D4952CY	B10	57 U	120	D3702DE	B10	44 U	340
	B16	44 U	150		B16	77 J	6010 L
	F10	44 U	140		F10	57 U	340
D4953CY	B10	44 U	280		G10	57 U	240
	B16	44 U	340		G10R	57 U	260
	F10	57 U	290	D3708DE	B10	57 U	330
D4956CY	B10	44 U	120		B16	140 J	320
	B16	57 U	89 J		F10	57 U	320
	F10	57 U	31 J	D3720DE	B10	57 U	360
	G10	57 U	76 J		B16	57 U	290
D4960CY	B10	44 U	74 J		F10	57 U	260
	B16	44 U	47 J	D3728DE	V10	57 U	47 J
	F10	57 U	96 J		V16	57 U	330
	F10R	44 U	110	D3738DE	B10	57 U	47 J
D4965CY	B10	44 U	230		B16	57 U	400
	B16	44 U	250		F10	57 U	210
	F10	44 U	310	D3742DE	B10	210	400
D4967CY	B10	44 U	160		B16	200	350
	B16	44 U	150		F10	140 J	330
	F10	44 U	150	D3750DE	B10	57 U	210
D4971CY	B10	44 U	56 J		B16	57 U	130
	B16	44 U	58 J		F10	48 U	480

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3754DE	B10	44 U	390	D4720EL	F10	57 U	98 J
	B16	44 U	420		P10	57 U	110
	F10	71 U	710		P16	57 U	78 J
	F10R	67 U	670	D4731EL	B10	64 J	47 J
D4344EL	B10	57 U	170		B16	57 U	30 U
	B16	93 J	170		F10	100 J	83 J
	S10	57 U	73 J	D4740EL	B10	57 U	72 J
	S10R	57 U	76 J		B16	57 U	35 J
	S20	57 U	57 J		F10	57 U	130
D4400EL	B10	57 U	140	D4741EL	B10	57 U	77 J
	B16	87 J	130		B16	57 U	45 J
	F10	57 U	120		F10	78 J	160
	G10	57 U	150	D4751EL	B10	57 U	110
D4423EL	B10	57 U	110		B16	57 U	30 U
	B16	57 U	45 J		F10	57 U	120
	F10	57 U	85 J	D4760EL	B10	44 U	98
D4431EL	B10	57 U	140		B16	57 U	48 J
	B16	44 U	68 J		F10	57 U	290
	F10	44 U	110	D4761EL	F10	59 J	150
D4433EL	F10	44 U	140		P10	57 U	30 J
	F16	44 U	150		P16	57 U	89 J
D4435EL	B10	44 U	100	D4770EL	G10	44 U	200
	B16	44 U	110		P10	44 U	91 J
	B20	44 U	110		P16	44 U	86 J
	B20R	44 U	110	D4771EL	B10	57 U	82 J
	B30	44 U	180		B16	57 U	63 J
	F10	44 U	110		F10	57 U	110
D4446EL	B10	44 U	91 J		F10R	57 U	130
	B16	44 U	120	D4790EL	B10	57 U	160
	F10	44 U	130		B16	57 U	190
D4701EL	B10	57 U	100		P10	44 U	100
	B16	57 U	130	D4791EL	B10	57 U	140
	F10	57 U	150		B16	57 U	120
	F10R	57 U	210		F10	57 U	190
D4711EL	B10	88 J	140	D4000FI	V10	44 U	130
	B16	57 U	52 J		V16	44 U	59 J
	F10	57 U	380		V20	44 U	99

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4010FI	B10	57 U	130		G10	44 U	110
	F10	57 U	87 J	D4144FI	B10	44 U	220
	F16	57 U	110		F10	44 U	170
D4021FI	B10	57 U	77 J		F16	44 U	190
	F10	57 U	290	D4145FI	B10	75 J	77 J
	F16	79 J	190		F10	44 U	87 J
D4027FI	B10	57 U	270		F16	44 U	63 J
	F10	57 U	240	D4161FI	B10	44 U	76 J
	F16	57 U	160		F10	44 U	47 J
D4035FI	B10	44 U	390		F16	44 U	59 J
	F10	44 U	150	D4309FI	B10	44 U	130
	F16	44 U	180		B16	44 U	110
D4044FI	B10	44 U	91 J		F10	44 U	180
	F10	57 U	140	D4319FI	B10	54 J	240
	F16	57 U	160		B16	57 J	270
D4047FI	B10	72 J	92 J		F10	70 J	230
	F10	57 U	190	D4323FI	B10	44 U	150
	F16	57 U	200		F10	44 U	150
D4050FI	B10	250	140		P10	44 U	160
	F10	68 J	190		P16	44 U	200
	F16	150	240	D4325FI	B10	44 U	160
D4051FI	B10	44 U	220		B16	44 U	130
	F10	44 U	220		F10	120 J	130
	F16	44 U	240	D4337FI	F10	44 U	140
D4109FI	B10	44 U	440		F20	44 U	89 J
	F10	44 U	110		F26	44 U	110
	F16	44 U	140	D4347FI	F10	44 U	110
D4110FI	B10	44 U	130		F20	44 U	110
	F10	44 U	94 J		F26	44 U	120
	F16	120 J	160	D4400FI	B10	57 U	98 J
	G10	44 U	84 J		F10	57 U	120
D4120FI	B10	44 U	320		P10	57 U	50 J
	F10	44 U	160		P16	57 U	81 J
	F16	44 U	130	D4424FI	B10	130 J	180
D4130FI	B10	88 J	270		F10	57 U	120
	F10	44 U	190		P10	77 J	99
	F16	46 J	160		P16	110 J	58 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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TABLE 4

Page 17 of 48



**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4437FI	B10	57 U	130		F10	57 U	130
	F10	57 U	340	D4610FI	B10	68 J	110
	F16	57 U	87 J		B16	140 J	150
D4442FI	B10	57 U	420		F10	180 J	140
	B16	57 U	190	D4615FI	B10	57 U	110
	F10	170 J	320		B16	57 U	94 J
D4450FI	B10	44 U	210		F10	58 J	99
	B16	44 U	120	D4620FI	B10	57 U	55 J
	F10	44 U	48 J		B16	57 U	47 J
	F10R	44 U	59 J		F10	170 J	220
	G10	44 U	200	D4630FI	F10	57 U	41 J
D4453FI	B10	44 U	130		F16	68 J	49 J
	B16	44 U	120	D4635FI	B10	57 U	140
	F10	44 U	130		B16	57 U	110
D4460FI	F10	57 U	240		F10	170 J	170
	F10R	57 U	260	D4640FI	B10	44 J	94 J
	F20	70 U	700		B16	52 J	91 J
	S10	57 U	170		F10	200	56 J
	S16	57 U	200	D4645FI	F10	57 U	84 J
D4503FI	B10	44 U	180		G10	57 U	66 J
	B16	44 U	150		P10	57 U	110
	F10	44 U	230		P16	57 U	97 J
D4515FI	B10	44 U	59 J	D4650FI	B10	77 J	120
	B16	44 U	230		B16	61 J	130
	F10	44 U	170		F10	160 J	140
D4522FI	B10	44 U	97	D4655FI	B10	44 U	330
	B16	44 U	99		F10	580	130
	F10	44 U	82 J		F16	44 U	73 J
	S10	44 U	72 J	D4670FI	B10	57 U	74 J
D4523FI	B10	44 U	140		B16	57 U	85 J
	B16	44 U	170		F10	57 U	140
	F10	44 U	150	D4675FI	B10	44 U	110
D4532FI	B10	44 U	91 J		B16	72 J	89 J
	B16	44 U	140		F10	75 J	160
	F10	44 U	88 J	D4680FI	B10	44 U	130
D4605FI	B10	57 U	140		B16	57 U	160
	B16	61 J	85 J		F10	57 U	190

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4695FI	B10	44 U	180		F10	44 U	80 J
	B16	44 U	210		G10	44 U	29 J
	F10	44 U	170	D4765FI	B10	44 U	210
D4705FI	B10	57 U	160		B16	44 U	87 J
	F10	130 J	330		F10	44 U	85 J
	F10R	56 U	560	D4766FI	B10	44 U	83 J
	F16	83 J	52 J		B16	44 U	57 J
D4710FI	B10	44 U	28 U		F10	44 U	43 J
	B16	44 U	28 U	D4773FI	B10	44 U	41 J
	F10	44 U	31 J		B16	57 U	48 J
D4715FI	B10	44 U	98		F10	54 J	110
	B16	44 U	76 J	D4775FI	B10	44 U	58 J
	F10	44 U	54 J		B16	44 U	78 J
D4720FI	B10	44 U	92 J		F10	180	490
	B16	44 U	50 J		G10	44 U	54 J
	F10	44 U	45 J	D4790FI	B10	44 U	240
D4725FI	B10	80 J	92 J		B16	44 U	73 J
	B16	44 U	94 J		F10	44 U	140
	F10	44 U	180	D4796FI	B10	44 U	80 J
D4730FI	B10	44 U	60 J		B16	44 U	120
	B16	44 U	37 J		F10	44 U	85 J
	F10	44 U	130	D4800FI	B10	57 U	99
D4740FI	B10	44 U	39 J		B16	61 J	110
	B16	49 J	28 U		F10	57 U	130
	F10	44 U	86 J	D4801FI	B10	200	120
D4745FI	B10	44 U	80 J		B16	100 J	68 J
	B16	44 U	67 J		F10	74 J	140
	F10	44 U	71 J	D4809FI	B10	57 U	73 J
D4750FI	B10	44 U	59 J		B16	44 U	57 J
	B16	44 U	46 J		F10	57 U	140
	F10	44 U	110	D4815FI	F10	220	99
	G10	57 U	55 J		F16	180 J	50 J
D4755FI	B10	44 U	61 J	D4820FI	B10	57 U	180
	B16	44 U	28 U		B16	57 U	78 J
	F10	44 U	93 J		F10	87 J	110
D4760FI	B10	44 U	51 J	D4825FI	B10	44 U	100
	B16	44 U	55 J		B16	57 U	80 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4825FI	F10	44 U	84 J		F10	44 U	110
D4828FI	B10	57 U	140	D5000FI	B10	44 U	80 J
	B16	57 U	110		B16	44 U	110
	F10	57 U	99		F10	44 U	98
D4835FI	B10	57 U	180	D5001FI	B10	44 U	91 J
	B16	57 U	140		B16	44 U	86 J
	F10	57 U	72 J		F10	44 U	180
D4851FI	B10	57 U	110	D5015FI	B10	120 J	97
	B16	57 U	100		B16	72 J	98
	F10	57 U	96 J		F10	66 J	89 J
D4859FI	B10	57 U	140	D5021FI	B10	44 U	100
	B16	57 U	110		B16	44 U	100
	F10	57 U	110		F10	44 U	50 J
D4860FI	B10	57 U	270	D5029FI	B10	44 U	210
	B16	80 J	120		B16	44 U	170
	F10	57 U	150		F10	44 U	140
D4904FI	B10	57 U	110	D5051FI	B10	44 U	87 J
	B16	57 U	69 J		B16	56 J	74 J
	F10	57 U	92 J		F10	44 U	75 J
	P10	44 U	100	D5057FI	B10	44 U	64 J
D4907FI	B10	44 U	120		B16	44 U	49 J
	B16	44 U	120		F10	44 U	130
	F10	270	190	D5071FI	B10	85 J	33 J
D4923FI	B10	44 U	110		B16	57 U	53 J
	B16	44 J	100		F10	57 U	130
	F10	120 J	84 J	D5112FI	B10	44 U	28 U
D4924FI	B10	44 U	190		B16	44 U	39 J
	B16	44 U	75 J		F10	44 U	200
	F10	44 U	190	D5175FI	P10	69 J	120
D4927FI	V10	44 U	72 J		S10	57 U	160
	V16	44 U	76 J		S16	57 U	100
	V20	44 U	84 J	D3760FR	B10	44 U	240
D4928FI	B10	44 U	88 J		F10	67 U	670
	B16	44 U	75 J		F16	44 U	340
	F10	44 U	97	D3763FR	B10	44 U	300
D4961FI	B10	44 U	60 J		B16	44 U	300
	B16	44 U	51 J		F10	44 U	150

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3766FR	F10	44 U	190	D3826FR	B10	44 U	110
	F16	44 U	150		F10	49 U	490
D3770FR	B10	44 U	340		F16	45 U	450
	F10	95 U	950	D3827FR	B10	44 U	310
	F16	56 U	560		B16	44 U	240
D3773FR	B10	44 U	230		F10	44 U	330
	S10	44 U	99	D3830FR	B10	48 J	470
	S16	44 U	110		F10	130 U	1300
D3774FR	B10	57 U	84 J		F16	110 U	1100
	F10	57 U	320	D3834FR	B10	44 U	310
	F16	57 U	400		F10	290	2200
D3778FR	B10	57 U	280		F16	170	1600
	F10	64 U	640	D4619FR	B10	57 U	440
	F16	57 U	360		B16	62 U	620
D3783FR	B10	44 U	170		F10	63 U	630
	B10R	44 U	260	D4631FR	B10	67 U	670
	B16	44 U	260		B16	90 U	900
	F10	44 U	160		F10	58 U	580
D3787FR	B10	44 U	200		G10	57 U	450
	B16	44 U	180	D4632FR	B10	57 U	360
	F10	48 U	480		B16	57 U	360
D3791FR	B10	44 U	220		S10	120 U	1200
	B16	44 U	250		S20	170 U	1700
	F10	44 U	290	D4639FR	V11	44 U	160
D3794FR	F10	57 U	200		V11R	44 U	110
	F16	44 U	190		V14	95 U	950
D3795FR	F10	120 J	170		V21	57 U	39 J
	F16	44 U	230	D4655FR	V11	44 U	290
D3799FR	B10	44 U	250		V16	450 U	4500
	B16	44 U	240		V21	44 U	370
D3811FR	B10	44 U	230	D4685FR	V11	44 U	39 J
	F10	44 U	350		V15	44 U	370
	S10	44 U	150		V21	44 U	75 J
	S16	44 U	200	D4700FR	V11	44 U	28 U
D3822FR	B10	44 U	270		V15	44 U	28 U
	F10	44 U	330		V21	44 U	28 U
	F16	44 U	340		V31	44 U	28 U

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D5101FR	V10	44 U	130	D3823GI	B10	57 U	260
	V20	44 U	28 U		F10	60 U	600
	V26	44 U	57 J		F16	71 U	710
D5560FR	V10	44 U	28 U	D3827GI	B10	44 U	230
	V20	44 U	28 U		F10	57 U	530
	V26	44 U	28 U		F16	57 U	430
D3770GI	B10	57 U	380	D3834GI	B10	57 U	530
	F10	57 U	560		F10	57 U	320
	F16	64 U	640		F16	110 J	280
D3772GI	B10	65 J	170	D3838GI	B10	57 U	170
	F10	57 U	230		F10	57 U	200
	F16	57 U	270		F16	57 U	230
D3774GI	B10	57 U	310	D3839GI	B10	44 U	280
	F10	57 U	460		F10	44 U	390
	F16	57 U	340		F16	44 U	400
D3778GI	B10	57 U	290		G10	57 U	330
	F10	57 U	460	D3842GI	B10	57 U	180
	F16	57 U	480		F10	100 U	1000
	P10	57 U	310		F16	89 U	890
D3779GI	B10	68 J	480	D3846GI	B10	60 J	220
	F10	110 U	1100		F10	57 U	420
	F16	140 J	990		F16	57 U	490
D3782GI	B10	57 U	250	D3849GI	B10	57 U	320
	F10	57 U	220		F10	57 U	390
	F16	57 U	270		F16	57 U	340
D3786GI	B10	57 U	420	D4334GY	B10	44 U	230
	F10	57 U	500		B16	57 U	170
	F16	61 U	610		F10	44 U	310
D3805GI	B10	57 U	290	D4342GY	B10	44 U	180
	F10	57 U	220		B16	44 U	210
	F16	57 U	270		F10	44 U	350
D3815GI	F10	44 U	410	D4701GY	B10	57 U	260
	F16	44 U	390		B16	62 J	310
	P10	44 U	270		F10	57 U	120
D3819GI	B10	57 U	210	D4704GY	F10	57 U	340
	F10	57 U	160		F20	57 U	370
	F16	57 U	230		S10	57 U	350

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4704GY	S16	62 J	360	D4750GY	B10	44 U	280
	S20	57 U	450		B16	57 J	260
	S26	57 U	430		F10	44 U	63 J
D4715GY	B10	57 U	250	D4754GY	B10	44 U	230
	B16	57 U	300		B16	44 U	350
	F10	89 J	250		F10	44 U	430
D4716GY	B10	77 J	38 J		G10	44 U	300
	B16	57 U	56 J	D4765GY	B10	44 U	330
	F10	57 U	59 J		B16	44 U	370
	F10R	63 J	57 J		F10	44 U	400
D4720GY	B10	77 J	460	D4771GY	B10	44 U	370
	F10	130 J	300		B16	44 U	400
	P10	76 J	250		F10	44 U	220
	P16	98 J	180	D4775GY	B10	44 U	87 J
D4723GY	B10	44 U	250		F10	44 U	74 J
	B16	44 U	320		P10	44 U	63 J
	F10	51 U	510		P16	44 U	340
D4726GY	B10	44 U	220	D4776GY	B10	44 U	220
	B16	44 U	240		B16	44 U	220
	F10	44 U	360		F10	49 U	490
D4729GY	B10	63 J	310	D4777GY	P10	44 U	28 U
	B16	44 U	290		P16	44 U	100
	F10	130 J	350		S10	44 U	60 J
	G10	44 U	280	D4780GY	B10	44 U	210
D4731GY	B10	44 U	230		B16	44 U	140
	B16	44 U	220		F10	44 U	260
	F10	44 U	190	D4784GY	F10	80 U	800
D4732GY	B10	58 J	260		F16	87 U	870
	S10	44 U	190		G10	57 U	240
	S16	44 U	220		G20	57 U	220
D4744GY	B10	44 U	140	D4795GY	B10	44 U	240
	B16	44 U	130		B16	190 U	1900
	F10	120 J	390		F10	44 U	200
D4745GY	F10	44 U	200	D3811HA	B10	44 U	90 J
	F10R	44 U	210		B16	44 U	62 J
	P10	44 U	110		F10	44 U	140
	P16	44 U	120	D3821HA	B10	44 U	55 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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TABLE 4

Page 23 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3821HA	B16	44 U	82 J		B16	44 U	28 U
	F10	44 U	110		F10	44 U	60 J
D3831HA	B10	44 U	130	D3971HA	B10	44 U	67 J
	B16	44 U	120		B16	44 U	69 J
	F10	60 J	96		F10	46 J	73 J
D3841HA	B10	44 U	110	D3991HA	B10	44 U	48 J
	B16	44 U	120		B16	44 U	45 J
	F10	44 U	120		F10	44 U	28 U
	G10	44 U	140	D3759HI	F10	57 U	390
D3851HA	B10	44 U	61 J		F16	57 U	340
	B16	44 U	50 J		P10	57 U	110
	F10	44 U	74 J	D3762HI	B10	57 U	78 J
D3861HA	B10	44 U	28 U		F10	57 U	170
	B16	44 U	42 J		F16	57 U	230
	F10	95 J	330		P10	57 U	150
D3901HA	B10	44 U	65 J	D3779HI	F10	57 U	290
	B16	44 U	74 J		F16	57 U	300
	F10	44 U	57 J	D3783HI	B10	57 U	270
D3909HA	B10	44 U	28 J		F10	57 U	270
	B16	44 U	37 J		F16	57 U	160
	F10	44 U	110	D3784HI	V10	57 U	140
D3911HA	B10	44 U	65 J		V16	57 U	130
	B16	44 U	58 J		V20	57 U	110
	F10	44 U	48 J	D3787HI	B10	57 U	170
D3921HA	B10	44 U	120		F10	57 U	61 J
	B16	44 U	95		F16	57 U	130
	F10	44 U	170		G10	57 U	140
D3931HA	B10	44 U	130	D3814HI	B10	44 U	320
	B16	44 U	80 J		F10	57 U	210
	F10	44 U	53 J		F16	57 U	300
D3941HA	B10	44 U	54 J	D3822HI	B10	44 U	280
	B16	44 U	48 J		F10	57 U	190
	F10	44 U	85 J		F16	57 U	280
D3951HA	B10	44 U	35 J	D3823HI	B10	57 U	430
	B16	44 U	28 U		F10	57 U	200
	F10	44 U	78 J		F16	57 U	460
D3961HA	B10	44 U	28 U	D3827HI	B10	57 U	540

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3827HI	F10	57 U	230		P16	57 U	330
	F16	57 U	260	D4653HI	B10	99 J	660
D3830HI	B10	44 U	230		B16	67 U	670
	F10	44 U	140		F10	160 J	420
	F16	44 U	160		G10	57 U	380
D3832HI	B10	44 U	390	D4662HI	B10	57 U	90 J
	F10	44 U	380		B16	57 U	83 J
	F16	44 U	320		F10	57 U	420
D3837HI	B10	67 J	200	D4668HI	F10	57 U	460
	F10	44 U	330		P10	57 U	410
	F16	57 U	380		P16	57 U	330
D3852HI	B10	57 U	47 J		S10	57 U	330
	F10	57 U	470		S10R	57 U	410
	F16	57 U	390	D4726HI	F10	57 U	250
D3918HI	B10	57 U	300		S10	57 U	420
	F10	57 U	470		S16	57 U	360
	F16	57 U	260	D4734HI	B10	57 U	260
D3922HI	B10	57 U	310		B16	57 U	220
	F10	57 U	31 J		F10	57 U	340
	F16	57 U	48 J		F10R	44 U	300
D4600HI	V10	57 U	65 J	D4746HI	B10	57 U	280
	V16	57 U	230		B16	57 U	280
	V20	57 U	75 J		F10	57 U	290
D4615HI	B10	44 U	250	D4757HI	B10	57 U	400
	B16	57 U	240		B16	57 U	110
	F10	44 U	290		F10	57 U	200
D4623HI	B10	44 U	420		P10	57 U	110
	F10	48 U	480	D4762HI	F10	57 U	250
	P10	57 U	350		P10	57 U	350
	P16	57 U	310		P16	57 U	320
D4635HI	B10	44 U	170		S10	57 U	250
	B16	57 U	230	D4764HI	B10	57 U	38 J
	F10	57 U	260		B16	57 U	110
	G10	57 U	300		F10	57 U	200
D4645HI	B10	57 U	390		F10R	57 U	160
	F10	57 U	46 J	D4767HI	B10	57 U	320
	P10	44 U	300		B16	57 U	270

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4767HI	F10	57 U	350	D3931HU	F10	49 U	490
D4768HI	B10	44 U	240		P10	44 J	200
	B16	160 U	1600		P16	44 U	290
	F10	44 U	230	D3934HU	B10	44 U	370
D4772HI	B10	57 U	280		B16	53 U	530
	B16	57 U	320		F10	44 U	170
	F10	57 U	160	D3937HU	B10	44 U	350
D4775HI	B10	420	800		B16	44 U	120
	F10	240	320		F10	44 U	260
	P10	57 U	200		F10R	44 U	230
	P16	280	170	D3947HU	B10	44 U	28 U
D4776HI	B10	57 U	180		B16	44 U	37 J
	B16	57 U	160		F10	44 U	200
	F10	57 U	250	D3957HU	F10	44 U	250
D4783HI	B10	120 J	300		P10	44 U	220
	B16	140 J	290		P16	44 U	240
	F10	350	400	D4605HU	V10	57 U	93 J
	F10R	650	670		V10R	57 U	38 J
D4786HI	F10	57 U	230		V20	57 U	74 J
	P10	76 J	250		V26	57 U	140
	P16	57 U	260	D4680HU	V11	44 U	64 J
D4792HI	F10	110 J	2770 L		V15	44 U	180
	G10	57 U	42 J		V21	44 U	32 J
	P10	57 U	220		V31	44 U	190
	P16	57 U	220	D3820JA	B10	44 U	39 J
D3911HU	B10	44 U	360		B16	44 U	58 J
	B16	44 U	360		F10	44 U	50 J
	F10	49 U	490	D3830JA	B10	44 U	28 U
D3919HU	B10	45 U	450		B16	44 U	28 U
	B16	44 U	370		F10	44 U	110
	F10	44 U	280	D3860JA	B10	44 U	65 J
D3921HU	B10	44 U	120		B16	44 U	52 J
	B16	49 U	490		F10	44 U	81 J
	F10	44 U	310	D3870JA	B10	44 U	72 J
D3925HU	B10	44 U	200		B16	44 U	67 J
	B16	44 U	260		F10	44 U	100
	F10	44 U	250	D3906JA	B10	44 U	86 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3906JA	B16	60 J	55 J		V16	44 U	28 U
	F10	1100	250		V20	44 U	320
D3910JA	B10	44 U	36 J	D4401JO	V10	44 U	300
	B16	44 U	28 U		V16	44 U	410
	F10	44 U	63 J		V20	44 U	380
D3920JA	B10	44 U	63 J	D4410JO	B10	57 U	350
	B16	44 U	50 J		B16	57 U	270
	F10	44 U	140		F10	57 U	420
	F10R	44 U	120	D4419JO	B10	76 U	760
D3930JA	B10	44 U	57 J		B16	85 U	5570 L
	B16	44 U	59 J		F10	57 U	260
	F10	44 U	97	D4428JO	B10	57 U	210
D3960JA	B10	44 U	74 J		B16	57 U	240
	B16	44 U	65 J		F10	57 U	360
	F10	56 J	80 J	D4432JO	F10	57 U	240
D3990JA	B10	240	150		F10R	57 U	270
	B16	320	190		G10	57 U	230
	F10	44 U	130		G16	57 U	350
	P10	140 J	230	D4436JO	B10	57 U	230
D4300JO	B10	57 U	280		B16	57 U	260
	B16	61 J	260		F10	57 U	470
	G10	57 U	180	D4442JO	B10	57 U	560
D4301JO	B10	44 U	240		B16	52 U	520
	B10R	44 U	220		F10	44 U	410
	B16	44 U	210	D4454JO	B10	44 U	200
	F10	44 U	180		B16	44 U	210
D4319JO	V10	44 U	180		F10	44 U	280
	V16	44 U	210	D4462JO	B10	44 U	120
	V20	44 U	53 J		B16	44 U	130
D4339JO	F10	44 U	210		F10	44 U	97
	G10	44 U	150	D4507JO	F10	57 U	200
	G16	52 J	130		S10	57 U	210
D4343JO	B10	57 U	100		S16	57 U	250
	F10	57 U	200	D4510JO	B10	44 U	230
	F16	57 U	160		B16	44 U	200
D4345JO	B10	57 U	490		F10	63 J	63 J
D4400JO	V10	44 U	79 J	D4516JO	B10	44 U	68 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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TABLE 4

Page 27 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4516JO	F10	57 U	40 J	D4665JO	B10	44 U	200
	S10	57 U	47 J		B16	44 U	290
	S16	44 U	37 J		F10	57 U	350
D4526JO	B10	60 J	110	D4669JO	B10	44 U	300
	F10	57 U	64 J		B16	44 U	300
D4529JO	B10	58 J	120		F10	44 U	240
	B16	57 U	140	D4670JO	B10	57 U	220
	F10	57 U	200		B16	57 U	200
D4536JO	B10	57 U	90 J		F10	57 U	220
	F10	57 U	93 J	D4673JO	B10	44 U	300
	S10	57 U	56 J		B16	44 U	310
	S16	57 U	85 J		F10	44 U	380
D4612JO	B10	57 U	400	D4674JO	B10	57 U	31 J
	B16	100 U	1000		F10	57 U	150
	F10	57 U	200		F16	57 U	150
D4632JO	B10	57 U	310	D4678JO	B10	57 U	150
	B16	57 U	360		B16	57 U	110
	F10	57 U	180		F10	57 U	490
D4636JO	B10	44 U	270	D4681JO	B10	44 U	71 J
	B16	57 U	260		B10R	44 U	95
	F10	57 U	330		F10	44 U	300
D4647JO	B10	57 U	340		F16	44 U	350
	B16	57 U	270	D4682JO	B10	57 U	200
	F10	57 U	230		B16	57 U	390
D4648JO	B10	57 U	190		F10	44 U	400
	B16	57 U	220	D4683JO	B10	44 U	330
	F10	57 U	150		B16	44 U	330
D4651JO	B10	57 U	290		F10	44 U	230
	B16	57 U	330	D4695JO	S10	44 U	130
	F10	57 U	330		S16	44 U	130
D4652JO	B10	57 U	310		S20	44 U	210
	B16	57 U	420	D4701JO	B10	57 U	52 J
	F10	130 J	220		B16	57 U	190
	F10R	57 U	340		S10	65 J	30 U
D4655JO	B10	44 U	330	D4707JO	B10	58 J	200
	B16	57 U	210		B16	57 U	170
	S10	57 U	160		F10	57 U	140

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

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F:\START\NDenver Soil\Database\ND-XRF.db1:kja

TABLE 4

Page 28 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4709JO	B10	57 J	130		F20	48 U	480
	B16	150 J	240		F26	66 U	660
	F10	57 U	170	D3852MA	B10	44 U	110
D4711JO	V10	57 U	200		F10	44 U	87 J
	V16	57 U	30 U		P10	44 U	51 J
	V20	57 U	64 J		P16	44 U	46 J
	V30	57 U	44 J	D3862MA	F10	44 U	55 J
D4712JO	B10	57 U	190		G10	44 U	54 J
	B16	64 J	200		P10	44 U	43 J
	S10	98 J	91 J		P10R	44 U	55 J
	S10R	57 U	120		P16	44 U	71 J
D4714JO	B10	44 U	150	D3865MA	B10	44 U	61 J
	B16	44 U	240		F10	44 U	57 J
	F10	57 U	110		P10	44 U	330
D4719JO	B10	57 U	200		P16	140 U	1400
	B16	57 U	210	D3875MA	B10	44 U	39 J
	F10	57 U	170		B16	44 U	38 J
D4722JO	B10	44 U	100		F10	44 U	33 J
	B16	44 U	140		G10	44 U	180
	S10	44 U	70 J	D3885MA	B10	44 U	91 J
D4736JO	B10	44 U	240		B16	44 U	66 J
	B16	44 U	130		F10	44 U	53 J
	S10	44 U	150	D3895MA	B10	44 U	48 J
D4740JO	B10	44 U	250		B16	44 U	31 J
	B16	44 U	180		F10	44 U	37 J
	F10	44 U	260		G10	44 U	34 J
D4430CK	F16	98 J	63 J	D4001MA	V10	44 U	89 J
D3803MA	F10	44 U	130		V20	44 U	200
	S10	44 U	110		V26	44 U	55 J
	S16	44 U	130	D4016MA	B10	44 U	300
D3808MA	B10	88 J	210		F10	44 U	150
	B16	160	200		F10R	44 U	170
	F10	150	200		P10	44 U	330
D3818MA	B10	620	640		P16	44 U	220
	B16	190	250	D4026MA	B10	44 U	190
	F10	910	500		B16	44 U	140
D3849MA	F10	44 U	67 J		F10	44 U	180

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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F:\START\NDenver Soil\Database\ND-XRF.db1:kja

TABLE 4

Page 29 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4035MA	B10	44 U	270		F16	57 U	52 J
	B16	44 U	240	D4131MI	B10	89 J	80 J
	F10	62 J	83 J		F10	85 J	180
D4043MA	B10	44 U	29 J		F16	68 J	160
	B16	44 U	28 U	D4155MI	B10	57 U	84 J
	F10	44 U	44 J		F10	57 U	71 J
D4103MA	B10	44 U	49 J		F16	57 U	79 J
	B16	44 U	59 J	D4161MI	B10	57 U	58 J
	F10	44 U	120		F10	57 U	89 J
D4111MA	B10	44 U	290		F16	57 U	59 J
	B16	98 U	980	D4310MI	B10	44 U	66 J
	F10	44 U	110		B16	44 U	55 J
D4137MA	B10	44 U	80 J		F10	57 U	85 J
	B16	44 U	62 J		G10	44 U	110
	F10	44 U	50 J	D4311MI	F10	57 U	77 J
D4151MA	B10	44 U	42 J		S10	57 U	96 J
	B16	44 U	63 J		S16	57 U	95 J
	F10	44 U	46 J	D4321MI	B10	57 U	120
D4016MI	B10	56 J	34 J		B16	57 U	97 J
	F10	44 U	120		F10	57 U	130
	F10R	76 J	130	D4324MI	B10	57 U	200
	F16	44 U	140		B16	57 U	140
D4100MI	B10	44 U	59 J		F10	57 U	190
	F10	44 U	80 J		F10R	57 U	190
	F16	44 U	41 J		P10	57 U	180
D4109MI	B10	57 U	110	D4328MI	B10	57 U	30 U
	F10	900	230		B16	57 U	55 J
	F16	170 J	89 J		F10	57 U	300
D4110MI	B10	57 U	36 J	D4335MI	B10	57 U	370
	F10	57 U	35 J		B16	57 U	130
	F16	57 U	49 J		F10	160 J	290
	G10	57 U	58 J		G10	57 U	200
D4118MI	B10	57 U	160	D4347MI	B10	57 U	150
	F10	57 U	87 J		B16	57 U	160
	F16	57 U	83 J		F10	57 U	260
D4119MI	B10	78 J	170		G10	57 U	66 J
	F10	66 J	45 J	D4355MI	B10	57 U	120

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4355MI	B16	57 U	120	D4543MI	B10	44 U	240
	F10	57 U	130		B16	44 U	160
D4421MI	B10	57 U	97 J		F10	57 U	570
	B16	57 U	92 J	D4625MI	B10	44 U	54 J
	F10	44 U	120		B16	44 U	60 J
D4424MI	B10	57 U	160		F10	44 U	62 J
	F10	120 J	120	D4630MI	B10	44 U	110
	P10	58 J	400		B16	54 J	68 J
	P16	78 J	80 J		F10	44 U	87 J
D4433MI	B10	100 U	1000	D4635MI	B10	44 U	42 J
	B16	62 J	230		B16	44 U	40 J
	F10	130 J	370		F10	44 U	28 U
	F10R	200	240	D4640MI	B10	44 U	100
D4450MI	B10	44 U	100		B16	44 U	87 J
	B16	44 U	84 J		F10	44 U	48 J
	F10	44 U	110	D4645MI	B10	44 U	56 J
	S10	44 U	93 J		B16	44 U	33 J
D4455MI	B10	67 J	140		F10	44 U	140
	B16	57 U	160	D4650MI	B10	44 U	49 J
	F10	73 J	93 J		B16	44 U	32 J
D4461MI	B10	44 U	200		F10	44 U	31 J
	B16	44 U	220	D4655MI	B10	57 U	190
	F10	62 J	100		B16	57 U	100
D4500MI	B10	44 U	72 J		F10	57 U	100
	B16	44 U	78 J		G10	57 U	74 J
	F10	44 U	92 J	D4660MI	B10	170 J	100
	F10R	44 U	94 J		B16	96 J	82 J
D4510MI	B10	44 U	36 J		F10	89 J	80 J
	F10	44 U	100	D4670MI	B10	94 J	80 J
	P10	44 U	95		B16	60 J	30 U
	P16	44 U	110		F10	81 J	71 J
D4518MI	B10	44 U	180	D4675MI	B10	57 U	120
	B16	44 U	210		B16	100 J	110
	F10	61 J	250		F10	57 U	57 J
D4524MI	B10	44 U	230	D4680MI	B10	70 J	190
	B16	44 U	250		B16	95 J	220
	F10	44 U	150		F10	190 J	170

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4685MI	B10	57 U	51 J		F10	44 U	130
	B16	74 J	50 J	D4801MI	B10	200	140
	F10	57 U	93 J		B16	170 J	110
D4695MI	B10	57 U	120		F10	350	150
	B16	230	290	D4808MI	B10	85 J	140
	F10	57 U	73 J		B16	57 U	220
D4700MI	B10	76 J	130		F10	110 J	120
	B16	64 J	260	D4809MI	B10	100 J	490
	F10	57 J	95 J		B16	130 J	480
D4701MI	B10	57 U	110		F10	270	160
	B16	57 U	130	D4816MI	B10	57 U	61 J
	F10	88 J	120		B16	64 J	30 J
D4705MI	B10	57 U	48 J		F10	57 U	64 J
	B16	57 U	30 U	D4833MI	B10	61 J	94 J
	F10	57 U	94 J		B16	57 U	160
D4720MI	F10	57 U	110		F10	57 U	80 J
	F16	57 U	55 J	D4840MI	B10	57 U	54 J
	S10	44 U	87 J		B16	44 U	45 J
D4725MI	B10	44 U	62 J		F10	57 U	52 J
	B16	44 U	68 J	D4852MI	B10	44 U	99
	F10	57 U	31 J		B16	44 U	130
D4745MI	B10	44 U	94 J		F10	44 U	120
	B16	49 J	130	D4855MI	B10	44 U	130
	F10	60 J	120		B16	44 U	130
D4750MI	F10	44 U	130		F10	44 U	120
	F16	44 U	44 J	D4900MI	B10	44 U	86 J
D4755MI	B10	150	67 J		B16	44 U	75 J
	B16	54 J	69 J		F10	44 U	210
	F10	530	250	D4901MI	B10	44 U	120
D4765MI	B10	44 U	85 J		B16	44 U	120
	B16	44 U	93 J		F10	44 U	48 J
	F10	44 U	44 J	D4905MI	B10	44 U	200
D4780MI	B10	44 U	120		B16	170	190
	B16	44 U	130		F10	230	220
	F10	44 U	70 J	D4909MI	B10	44 U	77 J
D4785MI	B10	44 U	82 J		B16	44 U	74 J
	B16	44 U	98		F10	210	270

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4912MI	B10	270	160	D4972MI	B10	63 J	72 J
	B16	190	190		B16	57 U	66 J
	F10	44 U	100		F10	110 J	59 J
D4913MI	B10	44 U	70 J	D4975MI	B10	44 U	100
	B16	44 U	67 J		B16	57 U	130
	F10	44 U	150		F10	44 U	82 J
D4920MI	B10	68 J	220	D4978MI	B10	44 U	98
	B16	110 J	280		B16	44 U	100
	F10	290	520		F10	44 U	54 J
D4921MI	B10	56 U	560	D4995MI	B10	44 U	77 J
	B16	44 U	170		B16	44 U	83 J
	F10	130 J	230		F10	44 U	73 J
D4924MI	B10	92 J	220	D5000MI	B10	44 U	72 J
	B16	97 J	120		B16	44 U	28 U
	F10	88 J	160		F10	44 U	88 J
D4925MI	B10	57 U	89 J		G10	44 J	64 J
	B16	57 U	95 J	D5001MI	B10	57 U	55 J
	F10	57 U	78 J		B16	57 U	80 J
D4929MI	B10	44 U	150		F10	44 U	91 J
	B16	44 U	230		F10R	57 U	90 J
	F10	44 U	77 J	D5015MI	B10	57 U	30 U
D4930MI	B10	86 J	92 J		B16	57 U	30 U
	B16	57 U	100		F10	87 J	57 J
	F10	44 U	120	D5016MI	B10	79 J	380
	P10	57 U	32 J		B16	57 U	140
D4961MI	B10	57 U	77 J		F10	57 U	240
	B16	57 U	100	D5019MI	B10	57 U	100
	F10	57 U	140		B16	57 U	120
D4965MI	B10	44 U	58 J		F10	57 U	150
	B16	57 U	33 J		G10	57 U	120
	F10	44 U	35 J	D5028MI	B10	57 U	30 U
D4968MI	B10	61 J	55 J		B16	57 U	30 U
	B16	57 U	60 J		F10	82 J	46 J
	F10	44 U	360	D5032MI	B10	57 U	150
D4970MI	B10	57 U	77 J		B16	57 U	310
	B16	57 U	66 J		F10	57 U	96 J
	F10	57 U	66 J		G10	57 U	83 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D5040MI	B10	44 U	75 J		B16	57 U	260
	B16	44 U	110		F10	44 U	200
	F10	44 U	330		G10	57 U	250
D5075MI	B10	44 U	74 J	D4339RA	B10	57 U	240
	B16	80 J	68 J		B16	57 U	360
	F10	80 J	62 J		F10	57 U	420
D5100MI	B10	44 U	28 U		G10	57 U	310
	B16	44 U	28 U	D4600RA	V10	57 U	170
	F10	44 U	31 J		V16	44 U	110
D5128MI	B10	44 U	28 U		V20	44 U	240
	B16	44 U	28 U	D4601RA	V10	44 U	170
	F10	44 U	28 U		V16	57 J	390
D5150MI	B10	44 U	69 J		V20	57 U	96 J
	B16	50 J	28 U	D4616RA	B10	65 U	650
	F10	44 U	90 J		B16	68 U	680
D5160MI	B10	44 U	53 J		F10	57 U	440
	B16	44 U	33 J		F10R	57 U	420
	F10	44 U	41 J	D4626RA	B10	57 U	220
D5170MI	B10	44 U	64 J		F10	57 U	260
	B16	44 U	76 J		P10	57 U	320
	F10	44 U	64 J		P16	57 U	320
	V10	44 U	78 J	D4647RA	B10	57 U	130
	V20	44 U	54 J		B16	57 U	49 J
	V26	44 U	55 J		F10	57 U	480
D4701PA	V10	44 U	38 J	D4651RA	B10	44 U	270
	V20	44 U	84 J		B16	44 U	400
	V26	44 U	84 J		F10	57 U	220
	V30	44 U	110	D4660RA	B10	44 U	440
	V40	44 U	91 J		B16	65 U	650
	V46	44 U	95		F10	44 U	200
	V50	44 U	56 J	D4669RA	B10	110 J	210
	V60	44 U	76 J		B16	110 J	230
	V66	44 U	69 J		F10	44 U	110
D5005PA	V10	44 U	29 J	D4684RA	F10	57 U	490
	V20	44 U	33 J		F16	44 U	250
	V26	44 U	79 J		G10	57 U	270
D4311RA	B10	57 U	420		G10R	57 U	240

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

75.71203.00

F:\START\N\Denver Soil\Database\ND-XRF.db1:kja

TABLE 4

Page 34 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4709RA	B10	95 U	950		B16	57 U	300
	B16	44 U	180		F10	57 U	110
	F10	44 U	240	D4754RA	S10	44 U	320
	F10R	44 U	280		S16	44 U	44 J
	S10	44 U	380		S20	44 U	200
D4710RA	B10	44 U	310	D4763RA	B10	57 U	280
	B16	44 U	340		F10	44 U	190
	F10	44 U	210		P10	57 U	420
D4721RA	B10	44 U	120		P16	57 U	190
	B16	44 U	280	D4766RA	B10	44 U	300
	F10	44 U	96		B16	52 J	200
	G10	44 U	250		F10	44 U	40 J
D4722RA	F10	60 U	600	D4772RA	B10	44 U	220
	F16	44 U	360		B16	44 U	330
	G10	44 U	370		F10	48 J	170
D4725RA	B10	57 U	60 J	D4775RA	B10	57 U	280
	B16	57 U	170		B16	44 U	280
	F10	61 U	610		F10	44 U	240
D4730RA	F10	55 U	550		G10	44 U	210
	F16	52 U	520	D4777RA	B10	44 U	260
	G10	44 U	310		B16	44 U	370
D4731RA	B10	57 U	120		P10	44 U	130
	B16	57 U	130	D4783RA	B10	44 U	340
	F10	57 U	230		F10	44 U	370
D4736RA	F10	160	470		P10	44 U	180
	F16	99 J	420		P16	44 U	260
	G10	44 U	180	D4786RA	B10	44 U	170
D4741RA	B10	57 U	150		F10	44 U	250
	B16	57 U	170		F16	44 U	210
	F10	57 U	37 J	D4805RA	V10	44 U	28 U
D4750RA	B10	44 U	68 J		V20	44 U	150
	B16	57 U	310		V26	44 U	230
	F10	44 U	190		V30	44 U	200
D4752RA	B10	44 U	260		V40	44 U	350
	B16	44 U	230		V46	44 U	300
	F10	44 U	270	D4701SC	B10	57 U	86 J
D4753RA	B10	57 U	250		B16	57 U	83 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4701SC	F10	57 U	99	D4785SC	B10	63 J	54 J
	F10R	57 U	110		B16	44 U	69 J
D4705SC	B10	57 U	54 J		F10	57 U	94 J
	B16	57 U	34 J	D4790SC	B10	44 U	70 J
	F10	57 U	63 J		B16	44 U	47 J
D4710SC	B10	92 J	110		F10	44 U	63 J
	B16	57 U	180	D4119SS	B10	44 U	41 J
	F10	57 U	37 J		F10	44 U	77 J
D4715SC	B10	700	240		F16	44 U	66 J
	B16	57 U	48 J	D4120SS	B10	44 U	77 J
	F10	57 U	36 J		F10	44 U	140
	G10	720	350		F16	44 U	110
D4725SC	B10	57 U	120	D4136SS	B10	44 U	85 J
	B16	57 U	130		F10	44 U	130
	F10	99 J	150		F16	44 U	150
D4730SC	B10	44 U	98		G10	44 U	98
	B16	44 U	88 J	D4144SS	B10	44 U	66 J
	F10	44 U	70 J		F10	44 U	93 J
D4735SC	B10	57 U	68 J		F16	44 U	92 J
	B16	57 U	80 J	D4145SS	B10	44 U	28 U
	F10	62 J	69 J		F10	44 U	78 J
	P10	57 U	38 J		F16	44 U	110
D4745SC	B10	57 U	110		P10	44 U	170
	B16	57 U	120	D4150SS	B10	44 U	71 J
	F10	57 U	67 J		F10	44 U	80 J
D4760SC	B10	230	61 J		F16	44 U	76 J
	B16	700	240	D4300SS	B10	57 U	110
	F10	410	280		F10	44 U	86 J
D4765SC	F10	44 U	110		F16	44 U	92 J
	S10	44 U	85 J	D4301SS	B10	57 U	81 J
	S16	44 U	54 J		B16	57 U	40 J
D4770SC	B10	57 J	96		F10	57 U	120
	B16	1200	330		G10	57 U	96 J
	F10	160	110	D4315SS	B10	57 U	100
D4780SC	B10	44 U	43 J		B16	57 U	98 J
	B16	44 U	30 J		F10	75 J	170
	F10	44 U	90 J	D4318SS	B10	44 U	100

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

75.71203.00

F:\START\N\Denver Soil\Database\ND-XRF.db1:kja

TABLE 4  
 Page 36 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4318SS	B16	44 U	69 J		B16	57 U	170
	F10	44 U	140		F10	57 U	120
	G10	44 U	90 J	D4434SS	B10	44 U	76 J
D4321SS	B10	57 U	100		F10	44 U	69 J
	B16	57 U	160		P10	44 U	180
	F10	57 U	97 J		P16	44 U	120
	G10	57 U	91 J	D4441SS	B10	86 J	150
D4325SS	B10	59 J	33 J		B16	65 J	200
	B16	57 U	51 J		F10	54 J	240
	F10	57 U	110		F10R	60 J	230
	F10R	57 U	120		G10	72 J	210
D4334SS	B10	550	1100	D4442SS	B10	44 U	100
	B16	110 J	250		B16	44 U	100
	F10	52 J	170		F10	44 U	91 J
	G10	44 U	150	D4451SS	B10	62 J	140
D4335SS	B10	100 J	360		B16	44 J	130
	B16	57 U	110		F10	570	340
	F10	57 U	340	D4460SS	B10	44 U	66 J
D4355SS	B10	44 U	55 J		B16	44 U	62 J
	B16	57 U	71 J		F10	44 U	38 J
	F10	57 U	97 J	D4461SS	B10	44 U	130
D4363SS	B10	57 U	110		B16	44 U	130
	B16	44 U	97		F10	44 U	120
	F10	81 J	95 J	D4701SS	B10	230	210
D4402SS	B10	87 J	72 J		B16	44 U	89 J
	B16	59 J	78 J		F10	140 J	150
	F10	66 J	140	D4710SS	B10	44 U	58 J
D4409SS	B10	59 J	93 J		B16	44 U	110
	B16	57 U	140		F10	44 U	54 J
	S10	57 U	200	D4730SS	B10	57 U	57 J
D4410SS	B10	57 U	76 J		B16	69 J	48 J
	B16	59 J	91 J		F10	44 U	88 J
	F10	57 U	130	D4740SS	B10	57 U	100
D4430SS	B10	44 U	44 J		B16	57 U	93 J
	B16	44 U	79 J		F10	57 U	94 J
	F10	110 J	410	D4750SS	B10	57 U	39 J
D4431SS	B10	57 U	150		B16	57 U	88 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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F:\START\N\Denver Soil\Database\ND-XRF.db1:kja

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4750SS	F10	57 U	93 J		G16	44 U	170
D4755SS	F10	57 U	110		P10	44 U	33 J
	F10R	57 U	110	D4859SS	B10	44 U	140
D4760SS	B10	57 U	96 J		B16	44 U	190
	B16	57 U	76 J		F10	44 U	100
	F10	57 U	140	D4906SS	B10	44 U	130
D4770SS	B10	57 U	30 U		B16	44 U	140
	B16	57 U	39 J		F10	44 U	150
	F10	57 U	54 J	D4914SS	B10	83 J	270
D4775SS	B10	57 U	42 J		B16	44 U	210
	B16	57 U	65 J		F10	200	350
	F10	57 U	79 J	D4922SS	B10	44 U	120
D4790SS	B10	57 U	55 J		B16	44 U	120
	B16	57 J	30 U		F10	44 U	85 J
	F10	57 J	67 J	D4930SS	B10	44 U	56 J
	P10	57 U	63 J		B16	44 U	64 J
D4804SS	B10	44 U	85 J		F10	44 U	120
	B16	44 U	60 J		P10	44 U	74 J
	F10	44 U	150	D4935SS	B10	44 U	150
D4809SS	B10	44 U	70 J		B16	44 U	130
	B16	44 U	58 J		F10	120 J	530
	F10	95 J	120	D4942SS	B10	44 U	130
D4815SS	B10	54 J	120		B16	44 U	150
	B16	46 J	120		F10	44 U	97
	F10	260	420		G10	44 U	73 J
D4833SS	B10	44 U	120	D4950SS	B10	44 U	91 J
	B16	44 U	110		B16	44 U	93 J
	F10	44 U	240		F10	44 U	120
D4834SS	B10	44 U	60 J	D4961SS	F10	44 U	35 J
	B16	44 U	58 J		F16	44 U	46 J
	F10	69 J	130		P10	44 U	65 J
	P10	44 U	28 U	D4965SS	B10	53 J	50 J
D4849SS	B10	44 U	150		B16	44 U	28 U
	B16	44 U	100		B20	100 J	92 J
	F10	44 U	88 J		F10	440	370
D4854SS	F10	63 J	42 J		F20	350	290
	G10	44 U	110	D4966SS	B10	44 U	71 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4966SS	B16	44 U	78 J	D5074SS	B10	44 U	65 J
	F10	44 U	74 J		B16	44 U	77 J
	G10	44 U	130		F10	44 U	130
D4970SS	B10	44 U	83 J		G10	44 U	84 J
	B16	44 U	43 J	D5075SS	B10	140 J	130
	F10	44 U	65 J		B16	70 J	83 J
D5001SS	B10	72 J	63 J		F10	70 J	310
	B16	44 U	100	D5078SS	B10	44 U	28 U
	F10	44 U	49 J		B16	44 U	36 J
D5015SS	B10	44 U	170		F10	44 U	93 J
	B16	44 U	140	D5083SS	B10	44 U	29 J
	F10	44 U	82 J		B16	44 U	73 J
D5018SS	B10	44 U	220		F10	44 U	58 J
	B16	44 U	280	D5086SS	B10	44 U	47 J
	F10	44 U	120		B16	44 U	64 J
	G10	44 U	100		F10	44 U	61 J
D5021SS	B10	44 U	140	D5096SS	B10	84 J	88 J
	B16	44 U	130		B16	87 J	80 J
	F10	44 U	110		F10	160	110
D5026SS	B10	44 U	80 J	D5102SS	B10	93 J	110
	B16	44 U	91 J		B16	89 J	120
	F10	44 U	130		F10	60 J	360
D5037SS	B10	44 U	410	D5111SS	B10	44 U	170
	B16	44 U	350		B16	44 U	150
	F10	44 U	95		F10	44 U	150
D5047SS	B10	44 U	150		P10	44 U	92 J
	B16	44 U	120	D5130SS	B10	44 U	120
	F10	44 U	79 J		B16	44 U	97
D5051SS	B10	44 U	120		F10	49 J	250
	B16	44 U	73 J	D5147SS	B10	44 U	130
	F10	44 U	130		B16	52 J	110
D5060SS	B10	44 U	33 J		F10	44 U	180
	B16	44 U	110	D5151SS	B10	44 U	84 J
	F10	44 U	160		B16	44 U	97
D5063SS	B10	91 J	110		F10	44 U	31 J
	B16	250	170		P10	44 U	53 J
	F10	44 U	83 J	D5157SS	B10	44 U	96

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D5157SS	B16	44 U	49 J		F10	660	400
	F10	44 U	92 J		F10R	1000	450
D5162SS	B10	44 U	110	D4101ST	B10	57 U	140
	B16	44 U	110		F10	57 U	190
	F10	44 U	120		F16	57 U	130
D5165SS	B10	44 U	180	D4115ST	B10	85 J	140
	B16	44 U	150		F10	69 J	160
	F10	44 U	74 J		F16	160 J	190
D5170SS	B10	110 J	140	D4135ST	F10	57 U	100
	B16	44 U	44 J		F16	57 U	92 J
	F10	68 J	91 J		F20	57 U	87 J
D5195SS	B10	44 U	48 J	D4142ST	B10	58 J	100
	B16	44 U	36 J		B16	57 U	140
	F10	660	290		F10	57 U	94 J
D3808ST	B10	44 U	380	D4145ST	B10	57 U	100
	B16	44 U	150		F10	130 J	800
	F10	44 U	240		F16	630	2800
D3816ST	B10	44 U	100	D4155ST	B10	57 U	110
	B16	57 U	72 J		F10	73 J	130
	F10	44 U	110		F16	64 J	110
D3830ST	B10	44 U	200	D4310ST	B10	44 U	160
	B16	57 U	250		B16	44 U	100
	F10	57 U	150		F10	44 U	110
D3838ST	B10	810	320	D4315ST	B10	44 U	360
	B16	280	78 J		B16	72 J	130
	F10	180 J	240		F10	65 J	100
D3868ST	B10	57 U	110		F10R	59 J	120
	B16	57 U	94 J	D4321ST	B10	62 J	150
	F10	57 U	120		B16	82 J	100
D3900ST	V10	44 U	48 J		F10	44 U	130
	V20	44 U	75 J	D4329ST	B10	44 U	110
	V26	44 U	28 U		B16	44 U	100
D3960ST	F10	57 U	100		F10	44 U	28 U
	F16	57 U	73 J	D4330ST	B10	44 U	73 J
	G10	57 U	79 J		B16	44 U	100
D4044ST	B10	250	250		F10	44 U	28 U
	B16	130 J	120	D4335ST	B10	57 U	250

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4335ST	B16	77 J	210		F10	44 U	130
	F10	57 U	130	D4802ST	B10	44 U	47 J
D4336ST	B10	440	170		B16	44 U	48 J
	B16	350	170		F10	44 U	55 J
	F10	770	460	D4812ST	B10	44 U	34 J
	F10R	530	380		B16	44 U	28 U
D4341ST	B10	44 U	90 J		F10	44 U	140
	B16	44 U	100	D4822ST	B10	44 U	66 J
	F10	57 U	51 J		B16	44 U	47 J
	G10	44 U	100		F10	44 U	80 J
D4355ST	B10	44 U	170		F10R	44 U	89 J
	B16	44 U	98	D4832ST	B10	44 U	80 J
	F10	44 U	52 J		B16	57 U	54 J
D4363ST	B10	80 J	120		F10	44 U	46 J
	B16	77 J	74 J	D4833ST	B10	44 U	64 J
	F10	44 U	210		B16	44 U	68 J
D4401ST	B10	44 U	170		F10	44 U	48 J
	B16	44 U	250	D4852ST	B10	57 U	43 J
	F10	44 U	210		B16	57 U	30 U
D4409ST	B10	44 U	120		F10	57 U	67 J
	B16	44 U	140	D4857ST	B10	44 U	290
	F10	44 U	120		B16	44 U	330
D4429ST	B10	44 U	46 J		F10	44 U	260
	F10	44 U	150	D4904ST	B10	58 J	30 U
	P10	44 U	58 J		F10	60 J	74 J
	P16	44 U	34 J		P10	57 U	68 J
D4439ST	B10	44 U	81 J		P16	57 U	30 U
	B16	44 U	71 J	D4905ST	B10	44 U	95
	F10	44 U	170		B16	44 U	120
D4445ST	B10	44 U	93 J		F10	53 J	130
	B16	44 U	110		G10	44 U	33 J
	F10	44 U	96	D4928ST	B10	57 U	36 J
D4455ST	B10	44 U	120		B16	57 U	30 U
	B16	44 U	28 U		F10	57 U	56 J
	F10	44 U	240		G10	57 U	36 J
D4463ST	B10	44 U	200	D4929ST	B10	86 J	150
	B16	44 U	200		B16	140 J	180

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4929ST	F10	150	130		B16	44 U	120
D4933ST	B10	44 U	120		F10	61 J	220
	B16	44 U	100	D5001ST	B10	44 U	59 J
	F10	44 U	70 J		B16	44 U	92 J
D4937ST	B10	44 U	58 J		F10	44 U	85 J
	B16	44 U	61 J	D5005ST	B10	44 U	66 J
	F10	92 J	63 J		B16	44 U	86 J
D4940ST	B10	410	240		B20	44 U	77 J
	B16	93 J	44 J		F10	44 U	90 J
	F10	960	550	D5010ST	B10	190	140
D4944ST	B10	57 U	54 J		B16	76 J	62 J
	B10R	62 J	59 J		F10	910	270
	B16	57 U	81 J	D5015ST	B10	44 U	110
	F10	57 U	91 J		B16	44 U	73 J
D4950ST	F10	57 U	55 J		F10	44 U	110
	S10	65 J	99		P10	44 U	130
	S16	57 U	100	D5023ST	B10	44 U	98
D4955ST	B10	44 U	140		B16	44 U	140
	B16	44 U	140		F10	44 U	79 J
	F10	44 U	260	D5031ST	B10	44 U	230
D4970ST	B10	57 J	180		B16	44 U	190
	B16	75 J	79 J		F10	76 J	150
	F10	57 U	250	D5040ST	B10	140 J	140
D4974ST	B10	95 J	62 J		B16	76 J	71 J
	B16	91 J	63 J		F10	53 J	100
	F10	100 J	150	D5044ST	B10	44 U	89 J
	G10	57 U	38 J		F10	130 J	730
D4980ST	B10	57 U	47 J		P10	47 J	360
	B16	44 U	48 J		P16	44 U	170
	F10	1200	230	D5050ST	B10	44 U	140
D4986ST	B10	44 U	78 J		B16	44 U	89 J
	B16	47 J	39 J		F10	44 U	130
	F10	92 J	130	D5055ST	B10	53 J	62 J
D4992ST	B10	44 U	88 J		B16	44 U	28 U
	B16	48 J	44 J		F10	44 U	86 J
	F10	540	240		G10	44 U	69 J
D4995ST	B10	44 U	150	D5060ST	B10	44 U	29 J

J - The associated numerical value is an estimated quantity between the detection limit and the quantitation limit.

U - The analyte was not detected above the detection limit. The detection limit is reported.

L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D5060ST	B16	44 U	28 U		B16	44 U	110
	F10	44 U	33 J		F10	44 U	84 J
	G10	44 U	28 U		G10	44 U	130
D5065ST	B10	44 U	190	D4300TH	B10	44 U	50 J
	B16	44 U	170		B16	44 U	62 J
	F10	44 U	140		F10	44 U	210
D5070ST	B10	45 J	67 J	D4301TH	B10	44 U	82 J
	B16	77 J	28 U		B16	44 U	89 J
	F10	44 U	60 J		F10	44 U	70 J
D5071ST	B10	44 U	110		G10	44 U	130
	B16	44 U	92 J	D4306TH	F10	44 U	430
	F10	44 U	120		F10R	44 U	410
D5075ST	B10	44 U	58 J		P10	44 U	170
	B16	44 U	35 J		P16	44 U	210
	F10	44 U	84 J		S10	44 U	290
D5078ST	B10	44 U	110	D4315TH	B10	44 U	92 J
	B16	44 U	76 J		B16	44 U	58 J
	F10	44 U	110		F10	100 J	180
D5079ST	B10	44 U	49 J	D4321TH	B10	44 U	120
	B16	44 U	57 J		B16	44 U	110
	F10	44 U	89 J		F10	44 U	110
D5088ST	B10	85 J	87 J	D4335TH	B10	44 U	430
	B16	44 U	87 J		B16	56 U	560
	F10	65 J	66 J		F10	57 U	110
D5098ST	B10	44 U	140	D4344TH	B10	57 U	240
	B16	44 U	78 J		B16	57 U	240
	F10	44 U	94 J		F10	57 U	150
D5101ST	B10	44 U	97	D4345TH	F10	44 U	120
	B16	44 U	130		F20	44 U	160
	F10	44 U	40 J		P10	44 U	370
D5135ST	B10	44 U	53 J		P16	44 U	130
	B16	44 U	64 J	D4352TH	B10	57 U	30 U
	F10	44 U	67 J		B16	57 U	30 U
D5143ST	B10	44 U	120		S10	57 U	100
	B16	44 U	85 J	D4355TH	B10	44 U	100
	F10	44 U	100		B16	57 U	110
D5181ST	B10	44 U	130		F10	44 U	330

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F:\START\NDenver Soil\Database\ND-XRF.db1:kja

TABLE 4

Page 43 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4358TH	B10	44 U	170		B20	44 U	260
	B16	44 U	220		B26	44 U	180
	F10	44 U	130		F10	44 U	230
D4363TH	B10	57 U	120		F20	280	360
	B16	57 U	50 J		F30	53 J	220
	F10	57 U	210		F36	44 U	170
D4401TH	B10	44 U	91 J		G10	44 U	140
	B16	44 U	69 J		S10	44 U	230
	F10	44 U	89 J		S20	130 J	210
D4417TH	B10	44 U	74 J	D4675TH	B10	44 U	140
	B16	44 U	67 J		B16	44 U	110
	F10	44 U	59 J		F10	44 U	150
	F10R	44 U	73 J	D4685TH	B10	44 U	140
D4431TH	B10	44 U	130		B16	44 U	100
	B16	44 U	130		F10	44 U	270
	S10	44 U	71 J	D4695TH	B10	44 U	80 J
D4435TH	B10	96 J	310		B16	44 U	89 J
	B16	420	340		F10	44 U	89 J
	F10	44 U	160	D4711TH	B10	1700	790
D4459TH	B10	360	360		B16	780	420
	F10	370	340		F10	220	200
	F10R	44 U	180	D4720TH	B10	44 U	120
	P10	72 J	230		B16	44 U	120
	P16	44 U	100		F10	45 J	230
D4500TH	B10	44 U	200		F10R	130 J	600
	B16	44 U	170	D4740TH	B10	50 J	58 J
	F10	50 J	240		B16	44 U	140
D4527TH	F10	44 U	120		F10	44 U	110
	F16	44 U	65 J	D4741TH	B10	44 U	240
	F20	44 U	110		B16	44 U	170
D4535TH	B10	44 U	110		F10	44 U	42 J
	B16	44 U	33 J	D4751TH	B10	44 U	79 J
D4545TH	B10	44 U	210		B16	44 U	120
	B16	44 U	200		F10	44 U	63 J
	F10	180	210	D4770TH	F10	44 U	100
D4625TH	B10	44 U	180		P10	44 U	56 J
	B16	44 U	330		P16	44 U	54 J

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U - The analyte was not detected above the detection limit. The detection limit is reported.

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4780TH	B10	44 U	60 J		S10	44 U	240
	B16	44 U	58 J	D4665VI	B10	44 U	300
	F10	44 U	88 J		B16	44 U	370
	G10	44 U	52 J		S10	44 U	370
D4790TH	B10	95 J	110	D4671VI	B10	44 U	74 J
	B16	44 U	31 J		B16	44 J	190
	F10	44 U	100		F10	44 U	390
D4791TH	F10	44 U	97		G10	44 U	28 U
	F10R	44 U	87 J	D4679VI	B10	57 U	300
	P10	44 U	110		F10	57 U	220
	P16	44 U	110		P10	57 U	300
D5162TH	P10	44 U	120		P16	57 U	180
	P16	44 U	100	D4690VI	F10	44 U	100
	P20	44 U	110		S10	44 U	67 J
D5174TH	F10	44 U	220		S16	44 U	90 J
D5178TH	B10	57 U	96 J	D4691VI	B10	530	620
	F10	44 U	140		B16	2400	1500
	F16	57 U	170		S10	57 U	110
D5180TH	B10	44 U	210		S10R	1300	730
	B16	44 U	160	D4700VI	F10	44 U	250
	F10	44 U	110		S10	44 U	290
D3100VA	V10	44 U	77 J		S16	49 U	490
	V16	44 U	46 J	D4701VI	B10	44 U	110
	V20	57 U	120		B16	44 U	130
	V30	57 U	77 J		F10	44 U	140
D4343VI	B10	44 U	360	D4705VI	B10	44 U	180
	B16	44 U	400		B16	44 U	180
	F10	57 U	340		F10	44 U	120
	F10R	44 U	260	D4718VI	B10	44 U	230
D4353VI	F10	57 U	150		B16	44 U	310
	S10	94 J	190		F10	58 J	310
	S16	76 J	220		F10R	44 U	260
D4639VI	B10	44 U	150	D4719VI	B10	44 U	280
	B16	44 U	420		B16	44 U	40 J
	F10	44 U	250		F10	44 U	100
D4641VI	B10	44 U	310		F20	44 U	200
	B16	79 J	250	D4727VI	B10	44 U	190

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75.71203.00

F:\START\N\Denver Soil\Database\ND-XRF.db1:kja

TABLE 4

Page 45 of 48

**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4727VI	B16	44 U	220	D4785VI	B10	57 U	160
	F10	44 U	190		B16	57 U	180
D4728VI	B10	44 U	180		F10	66 J	160
	B16	44 U	190		G10	60 J	220
	F10	44 U	310	D4786VI	B10	57 U	250
	G10	44 U	310		B16	57 U	230
D4729VI	B10	44 U	300		F10	57 U	100
	B16	44 U	170	D3700WA	V10	44 U	45 J
	F10	44 U	180		V20	44 U	96
D4732VI	B10	44 U	220		V26	44 U	160
	B16	44 U	400		V30	44 U	65 J
	F10	44 U	270	D3763WI	B10	57 U	180
D4733VI	B10	44 U	260		F10	57 U	280
	B16	44 U	210		F16	57 U	290
	F10	44 U	240	D3768WI	B10	57 U	260
D4735VI	B10	44 U	180		F10	57 U	130
	B16	44 U	220		F16	57 U	210
	F10	44 U	200	D3774WI	B10	57 U	150
D4751VI	B10	44 U	110		F10	57 U	200
	B16	44 U	130		F16	57 U	380
	F10	44 U	160	D3776WI	B10	57 U	260
	G10	44 U	280		F10	57 U	190
D4758VI	B10	44 U	240		F16	62 J	45 J
	B16	44 U	260	D3780WI	B10	57 U	130
	F10	50 J	260		F10	57 U	170
	F20	44 U	230		F16	57 U	260
D4768VI	F10	57 U	220	D3781WI	B10	57 U	270
	G10	57 U	260		F10	57 U	520
	S10	57 U	150		F16	57 U	480
	S16	81 J	130		P10	57 U	260
D4771VI	B10	44 U	230	D3811WI	F10	57 U	490
	B16	64 J	260		F16	57 U	430
	F10	780	1900		F20	57 U	260
	F10R	1400	2200	D3817WI	B10	44 U	200
D4773VI	B10	57 U	250		F10	57 U	140
	B16	58 J	200		F16	57 U	260
	F10	320	540	D3818WI	B10	44 U	170

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D3818WI	F10	44 U	170	D4660WI	B10	44 U	110
	F16	44 U	200		F10	44 U	190
D3830WI	B10	44 U	270		S10	44 U	140
	B10R	57 U	330		S16	44 U	99
	F10	66 U	660	D4674WI	B10	44 U	82 J
	F16	56 U	560		B16	44 U	64 J
D3834WI	B10	44 U	120		F10	44 U	170
	F10	44 U	240	D4675WI	F10	44 U	190
	F16	44 U	260		P10	44 U	160
D3839WI	B10	44 U	250		P16	44 U	73 J
	F10	57 U	360	D4680WI	B10	44 U	290
	F16	44 U	290		F10	44 U	310
D3843WI	B10	44 U	330		P10	44 U	160
	F10	86 J	350		P16	44 U	380
	F16	44 U	340	D4685WI	B10	44 U	130
D3942WI	B10	57 U	150		B16	46 J	170
	F10	57 U	510		F10	44 U	150
	F16	57 U	470	D4708WI	B10	48 U	480
D4632WI	B10	57 U	270		B16	49 U	490
	B16	57 U	180		F10	44 U	400
	F10	57 U	360		G10	44 U	330
	F10R	57 U	360	D4720WI	B10	120 J	200
D4643WI	B10	57 U	290		B16	68 J	34 J
	B16	57 U	160		F10	230	330
	F10	57 U	250		G10	44 U	130
D4644WI	V10	44 U	36 J	D4727WI	B10	150 J	480
	V20	44 U	250		B16	310	150
	V26	44 U	74 J		F10	110 J	430
D4650WI	B10	44 U	56 J	D4730WI	B10	91 J	200
	B16	44 U	120		B16	44 U	160
	F10	57 U	230		F10	44 U	240
D4651WI	B10	44 U	360		F10R	44 U	210
	B16	47 U	470		G10	57 U	200
	F10	44 U	270	D4735WI	B10	44 U	130
D4659WI	B10	44 U	210		B16	44 U	130
	B16	44 U	260		F10	57 U	210
	F10	730	440	D4738WI	B10	57 U	100

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**TABLE 4**  
**North Denver Residential Soils Spectrace 9000 XRF Data (mg/Kg)**

Sample	Location	Arsenic	Lead	Sample	Location	Arsenic	Lead
D4738WI	B16	88 J	61 J		F10	44 U	370
	F10	57 U	150	D4619YO	P10	44 U	110
D4747WI	B10	57 U	220		P16	44 U	110
	B16	57 U	170		S10	57 U	150
	F10	57 U	280		S20	44 U	140
	F10R	57 U	250	D4620YO	B10	44 U	170
D4750WI	B10	240	300		B16	44 U	180
	B16	100 J	47 J		S10	44 U	180
	F10	57 U	270	D4637YO	F10	59 J	240
	G10	57 U	57 J		F16	57 U	300
D4751WI	B10	57 U	390		S10	57 U	220
	B16	57 U	440	D4638YO	F10	44 U	100
	F10	58 U	580	D4642YO	B10	44 U	140
D4753WI	F10	67 U	670		B16	44 U	180
	S10	57 U	540		F10	44 U	330
	S16	57 U	390	D4650YO	B10	57 U	190
D4765WI	B10	57 U	150		B16	44 U	190
	B16	44 U	310		F10	44 U	370
	S10	57 U	210		G10	57 U	130
D4780WI	B10	44 U	290	D4656YO	B10	57 U	180
	B16	44 U	360		B16	57 U	280
	F10	44 U	230		G10	57 U	290
D4781WI	F10	44 U	390	D4657YO	V10	57 U	40 J
	S10	62 U	620		V16	57 U	52 J
	S16	44 U	420		V20	57 U	120
D4788WI	B10	44 U	150		V30	57 U	110
	F10	44 U	280	D4664YO	B10	57 U	290
	F16	44 U	170		B16	57 U	330
D3733WY	B10	59 U	590		F10	44 U	81 J
	B16	80 U	800		F10R	44 U	78 J
	F10	44 U	180	D4672YO	B10	57 U	280
D3739WY	B10	110 J	430		B16	57 U	250
	B16	170	590		F10	57 U	490
	F10	44 U	400	D4680YO	B10	57 U	35 J
	G10	44 U	180		B16	57 U	47 J
D3741WY	B10	51 J	450		F10	44 U	250
	B16	51 U	510				

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L - The XRF value was replaced with ICP analytical data because of being an outlier in the statistical evaluation of XRF vs laboratory data.

**TABLE 5**

**North Denver Residential Soils XRF/Laboratory  
Comparison**



**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D121338B10	69 U	14 J	N/A	690	817 J	-16.9
D180144V18	700 U	150	N/A	7000	7980	-13.1
D180144V28	400 U	33.8	N/A	4000	2000	66.7
D180144V324	800 U	128	N/A	8000	8500	-6.1
D250044VA6	44 U	8.3	N/A	400	546	-30.9
D282345F10	71 J	18.4 J	117.7	140	185 J	-27.7
D190147F10	160	140	13.3	290	248	15.6
D200047B10	120 J	42	96.3	260	1080	-122.4
D310047P10	72 J	6 U	N/A	36 J	43.8	-19.5
D312047F10	74 J	25.4	97.8	110	94.8	14.8
D270150F10	120 J	76.2	44.6	210	173 J	19.3
D3835ADF10	480	400	18.2	330	336	-1.8
D3910ADB10	67 J	41.4	47.2	100	104	-3.9
D4036ADV10	44 U	9.8	N/A	46 J	68	-38.6
D4130ADB10	44 U	8.3 J	N/A	100	105 J	-4.9
D4150ADF10	290	221 J	27.0	320	352 J	-9.5
D4335ADB10	57 U	7.9 J	N/A	130	126 J	3.1
D4450ADB10	88 J	26.9 J	106.4	52 J	105 J	-67.5
D4800ADF10	70 J	6 U	N/A	83 J	99.2 J	-17.8
D4831ADF10	94 J	118	-22.6	290	369 J	-24.0
D4841ADB16	74 J	6.3	168.6	30 U	47.2 J	N/A
D4850ADF10	2600	1500	53.7	530	477 J	10.5
D4860ADB10	98 J	42.9	78.2	67 J	49.9 J	29.3
D4860ADF10	73 U	55.5	N/A	730	802 J	-9.4
D4935ADF10	500	403	21.5	220	260 J	-16.7
D4959ADF10	750	607	21.1	220	221 J	-0.5
D4979ADF10	110 J	49.2	76.4	50 J	77.6	-43.3
D4990ADF10	160 J	95.2	50.8	320	317 J	0.9
D5001ADF10	140 J	28.5	132.3	52 J	68.9	-28.0
D5020ADB16	150	104	36.2	70 J	84.4	-18.7
D5020ADF10	560	389	36.0	310	244	23.8
D5030ADF10	490	367	28.7	340	330	3.0
D5067ADF10	140 J	167	-17.6	150	187	-22.0
D3801ARV10	44 U	7	N/A	320	408	-24.2
D4611BAB10	72 U	20.8	N/A	720	688	4.5
D4611BAB16	140 U	29.3	N/A	1400	1190	16.2
D4611BAF10	78 U	15.6	N/A	780	783	-0.4
D4615BAB10	91 U	26.6	N/A	910	932	-2.4
D4615BAB16	81 U	20.2	N/A	810	829	-2.3
D4645BAB16	64 J	15.8	120.8	500	448	11.0
D4660BAB10	80 U	17.2	N/A	800	780	2.5
D4712BAB10	73 U	8.7	N/A	730	554	27.4
D4712BAB16	57 U	15.6	N/A	540	521	3.6
D4764BAF10	78 J	9.3	157.4	240	348	-36.7
D4717BRB10	55 U	10.2	N/A	550	529	3.9
D4309CBF10	57 U	12.4	N/A	500	469	6.4
D4353CBB16	66 U	13.3	N/A	660	1130	-52.5

**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4395CBB10	57 U	59.8	N/A	550	694	-23.2
D4428CBB10	57 U	6 U	N/A	30 U	14.6	N/A
D4445CBF10	72 J	69.1	4.1	250	240	4.1
D4515CBF10R	130 J	65.9	65.4	230	252	-9.1
D4535CBF10	150	121	21.4	470	435	7.7
D4539CBF10	300	235	24.3	450	571	-23.7
D4637CBF10	57 U	6 U	N/A	170	198	-15.2
D4669CBF10	57 U	12.5	N/A	240	3920	-176.9
D4675CBF10	65 U	19.9	N/A	650	393	49.3
D4679CBB10	220	203	8.0	430	371	14.7
D4709CBB10	57 U	6.3	N/A	110	96.4	13.2
D4715CBF10	77 J	102	-27.9	260	353 J	-30.3
D4763CBF20	120 J	73.1	48.6	140	217	-43.1
D4770CBF16	340	282	18.6	560	514	8.6
D4780CBB10	290	300 J	-3.4	580	630 J	-8.3
D3855CKB10	98 J	51.6	62.0	120	105	13.3
D3909CKF10	44 U	39.9 J	N/A	240	274	-13.2
D4060CKB16	180	193	-7.0	190	278	-37.6
D4070CKF10	77 J	7.9	162.8	160	92	54.0
D4300CKF10	57 U	7.9 J	N/A	110	83.1 J	27.9
D4330CKF16	98 J	61.1 J	46.4	63 J	62.8 J	0.3
D4859CKB16	57 U	3.6	N/A	30 U	38.4	N/A
D4929CKF10	57 U	3.6	N/A	70 J	68.6	2.0
D4720CLB10	79 J	9.3 J	157.9	270	375	-32.6
D4765CLB16	170 J	110 J	42.9	120	150 J	-22.2
D4770CLF10	50 U	13 J	N/A	500	1100 J	-75.0
D4782CLF10	53 U	21	N/A	530	580 J	-9.0
D4783CLF10	44 U	15.2	N/A	160	196	-20.2
D4785CLF10	280	200	33.3	440	440	0.0
D4794CLF10	68 U	12	N/A	680	1900 J	-94.6
D3801COB10	44 U	3.1 J	N/A	39 J	42	-7.4
D3921COB10	150	94.5 J	45.4	59 J	52.6	11.5
D4052CYF10	61 U	5.5	N/A	610	590 J	3.3
D4162CYF10	89 J	61	37.3	170	160 J	6.1
D4162CYF16	94 J	34 J	93.8	86 J	66 J	26.3
D4325CYF10	100 J	94.4	5.8	180	178 J	1.1
D4325CYP10	88 J	89	-1.1	340	246	32.1
D4328CYF10	180 J	132	30.8	270	262 J	3.0
D4343CYF10	110 J	123	-11.2	310	353 J	-13.0
D4375CYS10	390	298	26.7	510	424 J	18.4
D4400CYF10	97 J	23.5	122.0	57 J	74.1 J	-26.1
D4401CYV50	44 U	1.3	N/A	28 U	3.4	N/A
D4512CYS10	210	177 J	17.1	290	327 J	-12.0
D4533CYF10	83 J	48.7	52.1	240	263 J	-9.1
D4641CYF10	490	330	39.0	550	507	8.1
D4650CYF10	140 J	37.7	115.1	170	117	36.9
D4651CYB10	210	146	36.0	150	139	7.6

**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4661CYF10	100 J	39.4	86.9	130	156	-18.2
D4664CYF10	45 J	68.4	-41.3	150	138	8.3
D4690CYF10	5600	2810	66.3	2100	1510	32.7
D4700CYB10	150	118	23.9	440	604	-31.4
D4701CYB10	44 U	8	N/A	190	168	12.3
D4705CYF10	170	140	19.4	80 J	92.6	-14.6
D4725CYF10	190	139	31.0	220	208	5.6
D4746CYF10	180	129	33.0	82 J	91.5	-11.0
D4780CYB10	65 J	96.4	-38.9	560	654	-15.5
D4809CYF10	800	539	39.0	480	409 J	16.0
D4811CYB10	200	85.3	80.4	430	321 J	29.0
D4841CYB16	44 U	8.9	N/A	140	174 J	-21.7
D4850CYF10	380	288	27.5	360	380 J	-5.4
D4864CYG10	57 U	7.9	N/A	140	125 J	11.3
D4921CYF10	81 J	61.6	27.2	170	176 J	-3.5
D4965CYB16	44 U	21.3	N/A	250	228 J	9.2
D3527DEB16	110 J	55.8	65.4	290	539	-60.1
D3638DEF16	44 U	6 U	N/A	28 U	13.4	N/A
D3702DEB16	77 J	16.5 J	129.4	440	6010 J	-172.7
D3708DEB16	140 J	13.9 J	163.9	320	406 J	-23.7
D3742DEB10	210	239 J	-12.9	400	467 J	-15.5
D3754DEF10	71 U	20.3	N/A	710	832	-15.8
D3754DEF10R	67 U	38.3 J	N/A	670	1040 J	-43.3
D4344ELB16	93 J	41.5	76.6	170	267	-44.4
D4400ELB16	87 J	14.2	143.9	130	128	1.6
D4435ELB10	44 U	6 U	N/A	100	131	-26.8
D4711ELB10	88 J	34.3	87.8	140	180	-25.0
D4720ELF10	57 U	13.5	N/A	98 J	127	-25.8
D4731ELF10	100 J	8.5	168.7	83 J	123	-38.8
D4741ELF10	78 J	6.8	167.9	160	173	-7.8
D4751ELF10	57 U	34	N/A	120	91.9	26.5
D4771ELB16	57 U	6.1	N/A	63 J	94.9	-40.4
D4021FIF16	79 J	25 J	103.8	190	180 J	5.4
D4047FIB10	72 J	5 U	N/A	92 J	110 J	-17.8
D4050FIB10	250	94	90.7	140	150	-6.9
D4110FIF16	120 J	41	98.1	160	170	-6.1
D4130FIB10	88 J	48	58.8	270	290 J	-7.1
D4145FIB10	75 J	55	30.8	77 J	71 J	8.1
D4319FIF10	70 J	128	-58.6	230	201	13.5
D4325FIF10	120 J	95.9	22.3	130	156	-18.2
D4424FIB10	130 J	77.9	50.1	180	144	22.2
D4442FIF10	170 J	109	43.7	320	317	0.9
D4460FIF10	57 U	6.9	N/A	240	303	-23.2
D4460FIF20	70 U	6.7	N/A	700	685	2.2
D4503FIB10	44 U	20.2	N/A	180	151	17.5
D4610FIF10	180 J	70.6	87.3	140	150	-6.9
D4635FIF10	170 J	89.1	62.4	170	168	1.2

**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4640FIF10	200	176	12.8	56 J	96.1	-52.7
D4650FIF10	160 J	109	37.9	140	172	-20.5
D4655FIF10	580	43.4	172.2	130	92	34.2
D4675FIF10	75 J	19.8	116.5	160	186	-15.0
D4680FIB16	57 U	20.5	N/A	160	156 J	2.5
D4705FIF10	130 J	145	-10.9	330	423	-24.7
D4725FIB10	80 J	61.8	25.7	92 J	109	-16.9
D4740FIB16	49 J	25.4	63.4	28 U	47.9	N/A
D4755FIB16	44 U	6 U	N/A	28 U	32.6	N/A
D4775FIF10	180	146	20.9	490	454 J	7.6
D4801FIB10	200	98	68.5	120	121 J	-0.8
D4815FIF10	220	150	37.8	99	118 J	-17.5
D4820FIF10	87 J	29.7	98.2	110	112 J	-1.8
D4825FIB16D	83 J	6 U	N/A	64 J	107	-50.3
D4907FIF10	270	273	-1.1	190	197 J	-3.6
D4923FIF10	120 J	124	-3.3	84 J	102 J	-19.4
D5015FIB10	120 J	76.8	43.9	97	104 J	-7.0
D5071FIB10	85 J	6 U	N/A	33 J	42.9 J	-26.1
D5112FIF10	44 U	27.1	N/A	200	205	-2.5
D3760FRF10	67 U	18 J	N/A	670	640 J	4.6
D3770FRF10	95 U	24 J	N/A	950	1200 J	-23.3
D3774FRF10	57 U	5 U	N/A	320	240 J	28.6
D3795FRF10	120 J	46.2 J	88.8	170	199 J	-15.7
D3830FRF10	130 U	49 J	N/A	1300	1700 J	-26.7
D3830FRF16	110 U	45.1	N/A	1100	1620	-38.2
D3834FRF10	290	290 J	0.0	2200	2800 J	-24.0
D4619FRF10	63 U	15.3	N/A	630	646	-2.5
D4631FRB16	90 U	57.2	N/A	900	963	-6.8
D4632FRS10	120 U	82.2	N/A	1200	1230	-2.5
D4632FRS20	170 U	63	N/A	1700	1650	3.0
D4639FRV14	95 U	54.9	N/A	950	842	12.1
D4655FRV16	450 U	108	N/A	4500	5100	-12.5
D3770GIF10	57 U	11	N/A	560	800 J	-35.3
D3779GIF10	110 U	60.9	N/A	1100	731	40.3
D3779GIF16	140 J	110 J	24.0	990	990 J	0.0
D3786GIF10	57 U	16	N/A	500	470 J	6.2
D3823GIF16	71 U	11	N/A	710	1000 J	-33.9
D3827GIF10	57 U	8 J	N/A	530	560 J	-5.5
D3834GIB10	57 U	6.2	N/A	530	587	-10.2
D3842GIF10	100 U	9.9	N/A	1000	1760	-55.1
D3842GIF16	89 U	11	N/A	890	1210	-30.5
D4715GYF10	89 J	74 J	18.4	250	290 J	-14.8
D4716GYB10	77 J	8.9	158.6	38 J	53 J	-33.0
D4720GYF10	130 J	120 J	8.0	300	330 J	-9.5
D4723GYF10	51 U	42	N/A	510	550 J	-7.5
D4729GYF10	130 J	110 J	16.7	350	430 J	-20.5
D4744GYF10	120 J	93.8	24.5	390	343	12.8

**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4784GYF10	80 U	12.5	N/A	800	906	-12.4
D4784GYF16	87 U	7.8	N/A	870	1100 J	-23.4
D4795GYB16	190 U	5 U	N/A	1900	2400	-23.3
D3861HAF10	95 J	75.4	23.0	330	357	-7.9
D3961HAB10	44 U	3.6	N/A	28 U	36.1	N/A
D3823HIF10	57 U	8.6	N/A	200	270	-29.8
D3827HIB10	57 U	8.6	N/A	540	511	5.5
D3830HIB10	44 U	6.2	N/A	230	189 J	19.6
D3837HIF10	44 U	8.3	N/A	330	296	10.9
D4600HIV20	57 U	6 U	N/A	75 J	280	-115.5
D4653HIB10	99 J	85.2	15.0	660	659	0.2
D4726HIF10	57 U	10.5	N/A	250	220	12.8
D4768HIB16	160 U	13.5	N/A	1600	1700	-6.1
D4775HIB10	420	237	55.7	800	594	29.6
D4783HIB10	120 J	80.3	39.6	300	267	11.6
D4783HIF10R	650	418	43.4	670	525	24.3
D4786HIP10	76 J	8.8	158.5	250	223	11.4
D4792HIF10	110 J	6 U	N/A	200	2770	-173.1
D3934HUB16	53 U	17.4 J	N/A	530	423 J	22.5
D3906JAF10	1100	738	39.4	250	240	4.1
D3990JAB10	240	184	26.4	150	125	18.2
D4419JOB10	76 U	12 U	N/A	760	1210	-45.7
D4419JOB16	85 U	13.4	N/A	850	5570	-147.0
D4442JOB10	57 U	18.2	N/A	560	618	-9.8
D4516JOS16	44 U	6 U	N/A	37 J	68.2	-59.3
D4612JOB16	100 U	9.6 J	N/A	1000	990 J	1.0
D4652JOF10	130 J	35 J	115.2	220	340 J	-42.9
D4665JOF10	57 U	7.7	N/A	350	380 J	-8.2
D4678JOF10	57 U	8	N/A	490	860 J	-54.8
D4701JOS10	65 J	5 UJ	N/A	30 U	36 J	N/A
D4709JOB16	150 J	100 J	40.0	240	230 J	4.3
D4712JOS10	98 J	25	118.7	91 J	120 J	-27.5
D3808MAF10	150	97.5	42.4	200	302	-40.6
D3818MAF10	910	911	-0.1	500	431	14.8
D3849MAF26	66 U	54.7	N/A	660	889	-29.6
D3865MAP16	140 U	8.5	N/A	1400	1550	-10.2
D4111MAB16	98 U	5.9	N/A	980	793	21.1
D4016MIF10R	76 J	67 J	12.6	130	120 J	8.0
D4109MIF10	900	1200	-28.6	230	250 J	-8.3
D4119MIB10	78 J	39 J	66.7	170	200 J	-16.2
D4131MIB10	89 J	28	104.3	80 J	100 J	-22.2
D4335MIF10	160 J	84.9	61.3	290	273	6.0
D4424MIF10	120 J	47.9	85.9	120	156 J	-26.1
D4433MIB10	100 U	67.8	N/A	1000	773 J	25.6
D4543MIF10	57 U	15.1	N/A	570	534	6.5
D4645MIB16	44 U	7.3	N/A	33 J	55 J	-50.0
D4660MIB16	96 J	43.8	74.7	82 J	99.3 J	-19.1



**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4670MIB10	94 J	45.2	70.1	80 J	95.3 J	-17.5
D4675MIB16	100 J	50.6	65.6	110	122 J	-10.3
D4680MIF10	190 J	143	28.2	170	205 J	-18.7
D4695MIB10	57 U	150	N/A	120	281 J	-80.3
D4701MIF10	88 J	42.3	70.1	120	157 J	-26.7
D4755MIF10	530	305	53.9	250	169 J	38.7
D4801MIF10	350	217	46.9	150	150 J	0.0
D4808MIF10	110 J	65.3	51.0	120	95.2 J	23.0
D4809MIF10	270	173	43.8	160	128 J	22.2
D4905MIF10	230	170 J	30.0	220	245	-10.8
D4909MIF10	210	164 J	24.6	270	272	-0.7
D4912MIB10	270	302	-11.2	160	121 J	27.8
D4920MIF10	290	267	8.3	520	549 J	-5.4
D4921MIB10	56 U	9.6	N/A	560	578 J	-3.2
D4921MIF10	130 J	68.9	61.4	230	182 J	23.3
D4924MIB10	92 J	89.3	3.0	220	186 J	16.7
D4930MIB10	86 J	11.1	154.3	92 J	126 J	-31.2
D4972MIF10	110 J	50.6	74.0	59 J	92.3 J	-44.0
D5015MIF10	87 J	37.1	80.4	57 J	66.7 J	-15.7
D5016MIB10	79 J	27.1	97.8	380	354	7.1
D5028MIF10	82 J	40.7	67.3	46 J	54.2	-16.4
D5075MIB16	80 J	92.7 J	-14.7	68 J	71.4	-4.9
D4701PAV30	44 U	6.2	N/A	110	91.9	17.9
D4616RAB10	65 U	13.3	N/A	650	801 J	-20.8
D4660RAB16	65 U	6 U	N/A	650	715 J	-9.5
D4669RAB10	110 J	93.6	16.1	210	224	-6.5
D4709RAB10	95 U	9	N/A	950	3280 J	-110.2
D4721RAF10D	44 U	16.1	N/A	67 J	73.1 J	-8.7
D4722RAF10	60 U	32.3	N/A	600	588	2.0
D4725RAF10	61 U	56.1	N/A	610	544	11.4
D4730RAF10	55 U	24.7	N/A	550	541	1.6
D4736RAF10	160	200	-22.2	470	484	-2.9
D4754RAS20	44 U	9.5	N/A	200	288	-36.1
D4805RAV10	44 U	3	N/A	28 U	9.5	N/A
D4710SCB10	92 J	26.4	110.8	110	131 J	-17.4
D4715SCB10	700	312	76.7	240	186 J	25.4
D4725SCF10	99 J	60.3	48.6	150	177 J	-16.5
D4760SCB16	700	593	16.6	240	289 J	-18.5
D4765SCF10	44 U	5.8	N/A	110	104	5.6
D4770SCB16	1200	744	46.9	330	294 J	11.5
D4315SSF10	75 J	56.5	28.1	170	167 J	1.8
D4334SSB10	550	369	39.4	1100	914 J	18.5
D4335SSB10	100 J	58	53.2	360	485 J	-29.6
D4363SSF10	81 J	46.5	54.1	95 J	113 J	-17.3
D4402SSB10	87 J	43.4	66.9	72 J	90.8 J	-23.1
D4430SSF10	110 J	143	-26.1	410	403 J	1.7
D4441SSB10	86 J	46.9	58.8	150	172 J	-13.7

**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4451SSF10	570	310	59.1	340	295 J	14.2
D4701SSB10	230	155	39.0	210	197 J	6.4
D4809SSF10	95 J	71.3 J	28.5	120	110	8.7
D4815SSF10	260	188 J	32.1	420	503	-18.0
D4914SSF10	200	133	40.2	350	350	0.0
D4935SSF10	120 J	114	5.1	530	484	9.1
D4965SSF10	440	324	30.4	370	359	3.0
D5015SSF10	44 U	6.7	N/A	82 J	84.4	-2.9
D5063SSB16	250	168	39.2	170	151	11.8
D5075SSB10	140 J	78.2	56.6	130	86.9	39.7
D5096SSB10	84 J	46.6	57.3	88 J	78.6	11.3
D5102SSB10	93 J	59.5	43.9	110	106	3.7
D5170SSB10	110 J	93.3	16.4	140	105	28.6
D5195SSF10	660	482 J	31.2	290	239	19.3
D3838STB10	810	550 J	38.2	320	298 J	7.1
D4044STF10	660	438 J	40.4	400	389 J	2.8
D4115STF16	160 J	81.6	64.9	190	203	-6.6
D4145STF10	130 J	193	-39.0	800	727	9.6
D4315STB16	72 J	85.9	-17.6	130	126 J	3.1
D4321STB16	82 J	47.6	53.1	100	81.5	20.4
D4335STB16	77 J	31.2	84.7	210	333	-45.3
D4336STB10	440	369 J	17.6	170	226 J	-28.3
D4336STF10	770	757 J	1.7	460	493 J	-6.9
D4363STB16	77 J	60.1	24.7	74 J	74.3 J	-0.4
D4929STF10	150	131 J	13.5	130	116	11.4
D4937STF10	92 J	63.6 J	36.5	63 J	75.3	-17.8
D4940STF10	960	619	43.2	550	476	14.4
D4970STB16	75 J	49.7	40.6	79 J	75.5	4.5
D4974STB10	95 J	53	56.8	62 J	64.4	-3.8
D4980STF10	1200	752	45.9	230	233	-1.3
D4986STF10	92 J	62.2 J	38.7	130	126	3.1
D4992STF10	540	491 J	9.5	240	267	-10.7
D5010STF10	910	734 J	21.4	270	269	0.4
D5031STF10	76 J	64.7 J	16.1	150	130	14.3
D5040STB10	140 J	86.3 J	47.5	140	154	-9.5
D5044STF10	130 J	197 J	-41.0	730	850	-15.2
D5088STB10	85 J	79.9 J	6.2	87 J	90.4	-3.8
D4315THF10	100 J	35.6 J	95.0	180	185	-2.7
D4335THB16	56 U	16.4	N/A	560	1110 J	-65.9
D4435THB16	420	296	34.6	340	331 J	2.7
D4459THB10	360	332	8.1	360	369 J	-2.5
D4535THB16	44 U	6 U	N/A	33 J	53.2	-46.9
D4545THF10	180	125	36.1	210	205	2.4
D4625THF20	280	311	-10.5	360	297	19.2
D4625THS20	130 J	105	21.3	210	217 J	-3.3
D4711THB10	1700	1100	42.9	790	865	-9.1
D4720THF10R	130 J	109	17.6	600	586	2.4

**TABLE 5**  
**North Denver Residential Soils XRF/Lab Comparison (mg/Kg)**

Sample ID	Arsenic			Lead		
	XRF	LAB	%RPD	XRF	LAB	%RPD
D4790THB10	95 J	78.7	18.8	110	103	6.6
D4353VIS10	94 J	38.1	84.6	190	226 J	-17.3
D4641VIB16	79 J	75.7	4.3	250	308	-20.8
D4671VIG10	44 U	6 U	N/A	28 U	20.1 J	N/A
D4690VIS10	44 U	2.8	N/A	67 J	69.4	-3.5
D4691VIB16	2400	1830	27.0	1500	1900	-23.5
D4768VIS16	81 J	7.8	164.9	130	162 J	-21.9
D4771VIF10	780	697	11.2	1900	2010	-5.6
D4773VIF10	320	203	44.7	540	410	27.4
D4786VIF10	57 U	9.4	N/A	100	156	-43.8
D3700WAV30	44 U	5.5	N/A	65 J	60.1	7.8
D3776WIF16	62 J	6 U	N/A	45 J	69.1	-42.2
D3781WIF10	57 U	18.9	N/A	520	524	-0.8
D3830WIF10	66 U	13.1	N/A	660	2240 J	-109.0
D3843WIF10	86 J	7.9	166.3	350	725	-69.8
D3942WIF10	57 U	13.4	N/A	510	533 J	-4.4
D4659WIF10	730	490	39.3	440	430 J	2.3
D4708WIB16	49 U	14.2	N/A	490	487 J	0.6
D4720WIB10	120 J	132	-9.5	200	238 J	-17.4
D4727WIB16	310	171	57.8	150	165 J	-9.5
D4727WIF10	110 J	37.3	98.7	430	516 J	-18.2
D4730WIB10	91 J	34.4	90.3	200	274 J	-31.2
D4738WIB16	88 J	38.6	78.0	61 J	84.4 J	-32.2
D4750WIB10	240	145	49.4	300	303 J	-1.0
D4751WIF10	58 U	10.6	N/A	580	630 J	-8.3
D4753WIS10	57 U	11.4	N/A	540	983 J	-58.2
D4781WIS10	62 U	14.2	N/A	620	588 J	5.3
D3733WYB10	59 U	13.3	N/A	590	582 J	1.4
D3733WYB16	80 U	18.5 J	N/A	800	801 J	-0.1
D3739WYB10	110 J	84	26.8	430	358 J	18.3
D3741WYB16	51 U	17.5	N/A	510	466 J	9.0
D4637YOF10	59 J	8.1	151.7	240	240 J	0.0
D4656YOB10	57 U	9.3	N/A	180	195 J	-8.0
D4680YOF10	44 U	9.5	N/A	250	249 J	0.4



**APPENDIX A**

**DATA VALIDATION REPORTS**

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805025-18	D4725CYF10	Soil	Total metals analysis for As, Cd, and Pb
9805025-19	D4746CYF10		
9805025-20	D4780CYB10		
9805025-21	D3638DEF16		
9805025-22	D3754DEF10		
9805025-23	D4344ELB16		
9805025-24	D4400ELB16		
9805025-25	D4435ELB10		
9805025-26	D4610FIF10		
9805025-27	D4635FIF10		
9805025-28	D4640FIF10		
9805025-29	D4650FIF10		
9805025-30	D4675FIF10		
9805025-31	D4725FIB10		
9805025-32	D4740FIB16		
9805025-33	D4755FIB16		
9805025-34	D4825FIB16D		
9805025-35	D3834GIB10		
9805025-36	D3842GIF10		
9805025-37	D4600HIV20		
9805025-38	D4419JOB10		
9805025-39	D4442JOB10		
9805025-40	D4516JOS16		
9805025-41	D4424MIF10		
9805025-42	D4433MIB10		
9805025-43	D4645MIB16		
9805025-44	D4660MIB16		
9805025-45	D4670MIB10		
9805025-46	D4675MIB16		
9805025-47	D4680MIF10		

**REGION VIII  
SUMMARY OF DATA QUALITY ASSURANCE REVIEW  
INORGANIC**

TDD No.	Site Name	Operable Unit	
9712-0003 / 75-71203	North Denver Soils		
RPM/OSC Name			
Peter Stevenson			
Contractor Laboratory	Contract No.	Order No.	Laboratory DPO/Region
Paragon Analytics, Inc.	Not Indicated	98-05-025	

Review Assigned Date May 21, 1998Data Validator Shelly R. JohnsenReview Completion Date June 2, 1998Report Reviewer Bill Fear

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805025-1	D250044VAG	Soil	Total metals analysis for As, Cd, and Pb
9805025-2	D310047P10		
9805025-3	D312047F10		
9805025-4	D4309CBF10		
9805025-5	D4353CBB16		
9805025-6	D4395CBB10		
9805025-7	D4428CBB10		
9805025-8	D4445CBF10		
9805025-9	D4515CBF10R		
9805025-10	D4535CBF10		
9805025-11	D4539CBF10		
9805025-12	D4669CBF10		
9805025-13	D4325CYP10		
9805025-14	D4641CYF10		
9805025-15	D4650CYF10		
9805025-16	D4651CYB10		
9805025-17	D4661CYF10		

## ACRONYMS

AA	Atomic Absorption
Ag	Silver
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRA	CRDL standard required for AA
CRDL	Contract Required Detection Limit
CRI	CRDL standard required for ICP
CV	Cold Vapor
EPA	U.S. Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
Hg	Mercury
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICSA	Interference Check Sample (Solution A)
ICSAB	Interference Check Sample (Solution AB)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LRA	Linear Range Verification Analysis
MSA	Method of Standard Additions
PDS	Post Digestion Spike
QC	Quality Control
RPD	Relative Percent Difference
RPM	Regional Project Manager
RSD	Percent Relative Standard Deviation
SA	Spike Added
SAS	Special Analytical Services
SDG	Sample Delivery Group
SOW	Statement of Work
SR	Sample Result
SSR	Spiked Sample Result
TPO	Technical Project Officer

## INORGANIC DATA QUALITY ASSURANCE REVIEW

### Region VIII

#### DATA QUALIFIER DEFINITIONS

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality. Use of additional qualifiers should be carefully considered. Definitions for all qualifiers used should be provided with each report.

#### GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA

- R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.
- J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
- U J - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.
- N J - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.

## XIX. LINEAR RANGE VERIFICATION ANALYSIS

Linear Range Verification Analysis (LRA) was performed and results were within control limits of  $\pm 5\%$  of the true value.

Yes\_\_\_ No\_\_\_ NA X

Comments: Linear range verification analysis was not provided.

## XX. FORM 13 - PREPARATION LOG

Information on the preparation of samples for analysis was reported on Form XIII.

Yes X No\_\_\_

Comments: All samples for ICP analysis were prepared on 04/27/98. The sample were evaluated for preparation blanks, matrix spike, and duplicate analysis in three separate sample preparation groups.

## XXI. FORM 14 - ANALYSIS RUN LOG

A Form XIV with the required information was filled out for each analysis run in the data package.

Yes\_\_\_ No X

Comments: Form XIV equivalents were not provided; however, an analytical sequence was provided and evaluated for each analyses set.

## XXII. Additional Comments or Problems/Resolutions not addressed above.

Yes\_\_\_ No X

Comments: None.

## XV. FORM 9 - ICP QC

A serial dilution was performed for ICP analysis with every twenty or fewer samples of a similar matrix, or one per sample delivery group, whichever is more frequent.

Yes X      No           NA     

Comments:      Summary forms were provided as a resubmission.

The serial dilution was without interference problems as defined by the SOW.

Yes X      No           NA     

Comments:      None.

## XVI. FORM 10 - QUARTERLY INSTRUMENT DETECTION LIMITS (IDL)

IDLs were provided for all elements on the target analyte list.

Yes           No X

Comments:      Reporting limits (RLs) were provided on the results summary forms. The laboratory provided a method detection limit study. The annual study was performed on 01/21/98.

## XVII. FORM 11 - INTERELEMENT CORRECTION FACTORS FOR ICP

Interelement corrections for ICP were reported.

Yes           No X

Comments:      Interelement correction factors were not provided.

## VIII. FORM 12 - ICP LINEAR RANGES

ICP linear ranges were reported.

Yes           No X

Comments:      ICP linear ranges were not provided.

Analytical spikes were performed on all GFAA samples and the percent recovery was 85 - 115%.

Yes\_\_\_ No\_\_\_ NA X

Comments: None.

MSAs were analyzed when required and the correlation coefficient was  $> 0.995$ .

Yes\_\_\_ No\_\_\_ NA X

Comments: None.

### XIII. FORM 7 - LABORATORY CONTROL SAMPLE

The laboratory control sample (LCS) was prepared and analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent):

Yes X No\_\_\_

Comments: None.

All results were within control limits.

Yes X No\_\_\_

Comments: None.

### XIV. FORM 8 - STANDARD ADDITION RESULTS

Results from graphite furnace standard additions were entered on Form VIII as directed in the SOW.

Yes\_\_\_ No\_\_\_ NA X

Comments: None.



Element	Sample Result (mg/kg)	Sample Duplicate (mg/kg)	%RPD	Samples Affected	Qualifiers
Chromium	13	8.8	38	D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J
Vanadium	20	14	35	D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J
Barium	57	84	38	D4050FIB10, D4110FIF16, D4785CLF10, D4795GYB16	J

For sample concentrations less than five times the CRDL, duplicate analysis results were within the control window of  $\pm$  CRDL (two times CRDL for soils).

Yes\_\_\_ No\_\_\_ NA X

Comments: None.

## XII. GFAA QC

Duplicate injections were performed on all GFAA samples and the RSD was within  $\pm$  20%.

Yes\_\_\_ No\_\_\_ NA X

Comments: None.

The RPDs were calculated correctly.

$$RPD = \frac{(S - D)}{(S + D)/2} \times 100$$

S = sample  
D = duplicate

Yes X No      NA     

Comments: None.

For sample concentrations greater than five times the CRDL, RPDs were within  $\pm 20\%$  (limits of  $\pm 35\%$  apply for soil/sediments/tailings samples).

Yes      No X NA     

Comments: The following table lists the duplicate analysis outside control limits (35%), matrix samples affected, and data qualifiers.

Element	Sample Result (mg/kg)	Sample Duplicate (mg/kg)	%RPD	Samples Affected	Qualifiers
Lead	1900	470	121	D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	J
Arsenic	67	32	71	D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Mercury	128%	Soil	D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D3770FRF10, D4765CLB16, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J
Antimony	72%	Soil	D4050FIB10, D4110FIF16, D4785CLF10, D4795GYB16	UJ
Copper	68%	Soil	D4050FIB10, D4110FIF16, D4785CLF10, D4795GYB16	J
Mercury	154%	Soil	D4050FIB10, D4110FIF16, D4785CLF10, D4795GYB16	J

The laboratory evaluated the spike recoveries using limits of 70-130%. The data were validated using QC limits of 75-125% as indicated in the functional guidelines.

## X. FORM 5B - POST DIGEST SPIKE RECOVERY

A post-digest spike was performed for those elements that did not meet the specified criteria (i.e., pre-digestion/pre-distillation spike recovery falls outside of control limits and sample result is less than four times the spike amount added, exception: Ag, Hg).

Yes ☒ No ☐ NA ☐

Comments: All post digestion spike recoveries were acceptable.

## XI. FORM 6 - DUPLICATE SAMPLE ANALYSIS

Duplicate sample analysis was performed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes ☒ No ☐

Comments: None.

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URS Operating Services, Inc. Data Validation Report

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Potassium	190%	Soil	D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	J
Antimony	60%	Soil	D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J/UJ
Lead	420%	Soil	D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J
Potassium	130%	Soil	D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	J

Spike recoveries were within the range of 75-125% (an exception is granted where the sample concentration is four times the spike concentration).

Yes\_\_\_ No X

Comments: The following table lists the spike recoveries outside control limits (75-125%), matrix, samples affected, and data qualifiers.

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Antimony	50%	Soil	D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	UJ
Barium	50%	Soil	D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	J
Magnesium	140%	Soil	D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	J

All analyzed blanks were free of contamination.

Yes ☐ No ☒

Comments: Two of the CCBs were contaminated with either copper (1.0 mg/Kg) or iron (6 mg/Kg). No action was required because these blanks were immediately reanalyzed and the reanalyses were free from contamination. Additionally, the associated sample results were above the 5 times action level.

The blanks were reported to the reporting limit as opposed to an instrument detection limit. No assessment was made to the MDL values provided by the laboratory upon resubmission.

## VIII. FORM 4 - ICP INTERFERENCE CHECK SAMPLE

The ICP interference check sample (ICS) was run twice per eight hour shift and/or at the beginning and end of each sample set analysis sequence (whichever is more frequent).

Yes ☒ No ☐

Comments: None.

Percent recovery of the analytes in solution ICSAB were within the range of 80-120%.

Yes ☒ No ☐

Comments: Summary forms were provided as a resubmission.

## IX. FORM 5A - MATRIX SPIKE SAMPLE ANALYSIS

A matrix spike sample was analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes ☒ No ☐

Comments: None.

The percent recoveries (%R) were calculated correctly.

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result  
SR = sample result  
SA = spike added

Yes ☒ No ☐ NA ☐

Comments: None.

## VI. FORM 2B - CRDL STANDARD FOR ICP AND AA

ICP Analysis: Standards (CRI) at two times the CRDL or the IDL (whichever were greater) were analyzed at the beginning and the end of each sample run, or at a minimum of twice per eight hours, whichever was more frequent.

Yes X No     

Comments: None.

GFAA Analysis: Standards (CRA) at two times CRDL were analyzed at the beginning of each sample run.

Yes      No      NA X

Comments: None.

The CRI and/or the CRA were analyzed after the ICV.

Yes X No     

Comments: None.

## VII. FORM 3 - BLANKS

The initial and continuing calibration blanks (ICB and CCB, respectively) met SOW requirements.

Yes X No     

Comments: None.

The continuing calibration blanks were run at 10% frequency.

Yes X No     

Comments: None.

A laboratory/preparation blank was run at the frequency of one per twenty samples, or per sample delivery group (whichever is more frequent), and for each matrix analyzed.

Yes X No     

Comments: None.

The instruments were calibrated using one blank and the appropriate number of standards.

Yes X No     

Comments: None.

#### IV. FORM 1 - SAMPLE ANALYSIS RESULTS

Sample analyses were entered correctly on Form Is.

Yes X No     

Comments: The sample results were reported on a wet weight basis.

#### V. FORM 2A - INITIAL AND CONTINUING CALIBRATION VERIFICATION

The initial and continuing calibration verification standards (ICV and CCV, respectively) met SOW requirements.

Yes X No     

Comments: None.

The calibration verification results were within 90-110% recovery for metals.

Yes X No     

Comments: None.

The continuing calibration standards were run at 10% frequency.

Yes X No     

Comments: None.



## I. DELIVERABLES

All deliverables were present as specified in the Statement of Work (SOW).

Yes\_\_\_ No X

Comments: Summary forms for the initial calibration and continuing calibration verification (Form 2A equivalent), CRDL standard verification (Form 2B equivalent), initial and continuing calibration blank results (Form 3 equivalent), ICP interference check sample results (Form 4 equivalent), and the ICP Serial Dilution summary (Form 9 equivalent) were not provided in the data package. These summary forms were provided as a resubmission. The mercury calibration and blank results were not included on summary forms. The raw data were reviewed and all QC criteria met.

## II. HOLDING TIMES

All CLP-SOW holding times were met.

Yes X No\_\_\_

Comments: None.

All 40 CFR Part 136 technical holding times were met.

Yes X No\_\_\_

Comments: None.

## III. INSTRUMENT CALIBRATIONS: STANDARDS AND BLANKS

Initial instrument calibrations were performed according to SOW requirements.

Yes X No\_\_\_

Comments: None.

The instruments were calibrated daily and each time an analysis run was performed.

Yes X No\_\_\_

Comments: None.

Method/SOW Number SW-846 6010/7471  
Revision 6010A

## Inorganic Deliverables Completeness Checklist

<u>P</u>	Inorganic Cover Page		
<u>P</u>	Inorganic Analysis Data Sheets (Form I)		
<u>R</u>	Initial Calibration and Calibration Verification Results (Form II)		
<u>R</u>	Continuing Calibration Verification Results (Form II)		
<u>R</u>	CRDL Standard for ICP and AA (Form II, Part 2)		
<u>R</u>	Blank Analysis Results (Form III)		
<u>R</u>	ICP Interference Check Sample Results (Form IV)		
<u>P</u>	Spiked Sample Results (Form V)		
<u>P</u>	Post-digest Spiked Sample Analysis (Form V, Part 2)		
<u>P</u>	Duplicate Sample Results (Form VI)		
<u>NP</u>	Instrument Detection Limits (Form VII) or (Form X - Quarterly)		
<u>P</u>	Laboratory Control Sample results (Form VII)		
<u>NA</u>	Standard Addition Results (Form VIII)		
<u>R</u>	ICP Serial Dilution Results (Form IX)		
<u>NA</u>	Holding Times Summary Sheet (Form X)		
<u>NP</u>	ICP Interelement Correction Factors (Form XII - Quarterly or Form XI - Annually)		
<u>NP</u>	ICP Linear Ranges (Form XII (XII) - Quarterly)		
<u>P</u>	Raw Data		
<u>P</u>	Samples	<u>P</u>	Calibration Standards
<u>P</u>	Duplicates	<u>P</u>	ICP QC (ICS and Serial Dilution)
<u>NA</u>	Furnace AA	<u>P</u>	Mercury Analysis
		<u>P</u>	Blanks
		<u>P</u>	Spikes
		<u>P</u>	LCS
		<u>NA</u>	Cyanide Analysis
<u>NP</u>	Percent Solids Calculations - Solids Only		
<u>P</u>	Sample Prep/Digestion Logs (Form XIII)		
<u>NP</u>	Analysis Run Log (Form XIV)		
<u>P</u>	Chain-of-Custody		
<u>NP</u>	Sample Description		
<u>P</u>	Case Narrative		
<u>P</u>	Method References		

### KEY:

P = Provided in original data package, as required by the SOW  
 R = Provided as Resubmission  
 NP = Not provided in original data package or as resubmission  
 NR = Not required under the SOW  
 NA = Not applicable to this data package or analysis

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## URS Operating Services, Inc. Data Validation Report

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	Lead	J	Duplicate RPDs exceeded 35%	XI
D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	Arsenic Chromium Vanadium	J		
D4050FIB10, D4110FIF16, D4785CLF10, D4795GYB16	Barium	J		

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10, D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	Potassium	J	Matrix spike recoveries were outside QC limits of 75-125%.	IX
D4119MIB10, D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D4162CYF16, D3770FRF10, D4765CLB16, D4701JOS10, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R	Lead	J		
D4709JOB16, D3779GIF16, D4612JOB16, D4720GYF10, D4780CBB10, D3834FSF10, D4652JOF10, D3827GIF10, D3830FRF10, D4021FIF16, D3770FRF10, D4765CLB16, D4715GYF10, D4770CLF10, D4729GYF10, D3760FRF10, D4016MIF10R,	Mercury	J		
D4050FIB10, D4110FIF16, D4785CLF10, D4795GYB16	Copper Mercury	J		

## INORGANIC DATA QUALITY ASSURANCE REVIEW

### REVIEW NARRATIVE SUMMARY

This data package was reviewed according to "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," February 1994, modified for method use.

TDD No. 9712-0003 / 75-71203, Order No. 98-04-190 consisted of 44 soil samples for metals by SW-846 method 6010 and mercury analysis by method 7471.

The following table lists the data qualifiers added to the sample analyses. Please see Data Qualifier Definitions, attached to the end of this report.

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
All samples	Antimony	J/UJ	Matrix spike recoveries were outside QC limits of 75-125%.	IX
D4052CYF10, D4047FIB10, D3786GIF10, D4162CYF10, D4678JOF10, D4665JOF10, D4784GYF16, D4637YOF10, D3823GIF16, D3770GIF10, D3774FRF10, D4130FIB10, D4716GYB10, D4131MIB10, D4712JOS10, D4782CLF10, D4723GYF10, D4109MIF10, D4145FIB10, D4794CLF10	Barium Magnesium	J		

## DATA QUALITY STATEMENT

- ( ) Data are ACCEPTABLE according to EPA Functional guidelines with no qualifiers (flags) added by the reviewer.
- ( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
- (X) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes \_\_\_\_\_ No X

TPO Attention Required? Yes \_\_\_\_\_ No X If yes, list the items that require attention:

# UOS

URS Operating Services, Inc. Data Validation Report

Laboratory Sample ID	Sample Location	Matrix	Analysis
9804190-19A	D4145FIB10	Soil	SW-846 Method 6010-Total Metals, and Method 7471-Mercury analysis
9804190-20A	D4794CLF10		
9804190-21A	D4119MIB10		
9804190-22A	D4709JOB16		
9804190-23A	D3779GIF16		
9804190-24A	D4612JOB16		
9804190-25A	D4720GYF10		
9804190-26A	D4780CBB10		
9804190-27A	D3834FSF10		
9804190-28A	D4652JOF10		
9804190-29A	D3827GIF10		
9804190-30A	D3830FRF10		
9804190-01A	D4052CYF10		
9804190-02A	D4047FIB10		
9804190-03A	D3786GIF10		
9804190-04A	D4162CYF10		
9804190-05A	D4678JOF10		
9804190-06A	D4665JOF10		
9804190-07A	D4784GYF16		
9804190-08A	D4637YOF10		
9804190-09A	D3823GIF16		
9804190-10A	D3770GIF10		
9804190-11A	D3774FRF10		
9804190-12A	D4130FIB10		
9804190-13A	D4716GYB10		
9804190-14A	D4131MIB10		
9804190-15A	D4712JOS10		

## REGION VIII SUMMARY OF DATA QUALITY ASSURANCE REVIEW INORGANIC

TDD No.	Site Name	Operable Unit	
9712-0003 / 75-71203	North Denver Soils		
RPM/OSC Name			
Peter Stevenson			
Contractor Laboratory	Contract No.	Order No.	Laboratory DPO/Region
Analytica Environmental Laboratories	Not Indicated	98-04-190	

Review Assigned Date May 21, 1998 Data Validator Shelly R. Johnsen  
Review Completion Date June 2, 1998 Report Reviewer Bill Fear

Laboratory Sample ID	Sample Location	Matrix	Analysis
9804190-31A	D4021FIF16	Soil	SW-846 Method 6010-Total Metals, and Method 7471-Mercury analysis
9804190-32A	D4162CYF16		
9804190-33A	D3770FRF10		
9804190-34A	D4765CLB16		
9804190-35A	D4701JOS10		
9804190-36A	D4715GYF10		
9804190-37A	D4770CLF10		
9804190-38A	D4729GYF10		
9804190-39A	D3760FRF10		
9804190-40A	D4016MIF10R		
9804190-41A	D4050FIB10		
9804190-42A	D4110FIF16		
9804190-43A	D4785CLF10		
9804190-44A	D4795GYB16		
9804190-16A	D4782CLF10		
9804190-17A	D4723GYF10		
9804190-18A	D4109MIF10		



Laboratory Sample ID	Sample Location	Matrix	Analysis
9805025-48	D4695MIB10	Soil	Total metals analysis for As, Cd, and Pb
9805025-49	D4701MIF10		
9805025-50	D4755MIF10		
9805025-51	D4616RAB10		
9805025-52	D4660RAB16		
9805025-53	D4315SSF10		
9805025-54	D4334SSB10		
9805025-55	D4335SSB10		
9805025-56	D4363SSF10		
9805025-57	D4402SSB10		
9805025-58	D4430SSF10		
9805025-59	D4441SSB10		
9805025-60	D4451SSF10		
9805025-61	D4701SSB20		
9805025-62	D4315STB16		
9805025-63	D4363STB16		
9805025-64	D4335THB16		
9805025-65	D4435THB16		
9805025-66	D4459THB10		
9805025-67	D4625THS20		
9805025-68	D4353VIS10		
9805025-69	D4768VIS16		
9805025-70	D3830WIF10		
9805025-71	D3942WIF10		
9805025-72	D3733WYB10		
9805025-73	D3739WYB10		
9805025-74	D3741WYB16		
9805025-75	D4656YOB10		
9805025-76	D3830HIB10		
9805025-77	D4671VIG10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805025-78	D4709RAB10	Soil	Total metals analysis for As, Cd, and Pb
9805025-79	D4715CBF10		
9805025-80	D4721RAF10D		
9805025-81	D4722RAF10		
9805025-82	D4730RAF10		
9805025-83	D4744GYF10		
9805025-84	D4784GYF10		
9805025-85	D4790THB10		
9805025-86	D200047B10		
9805025-87	D4115STF16		
9805025-88	D4145STF10		
9805025-89	D4675CBF10		
9805025-90	D4679CBB10		
9805025-91	D4720ELF10		
9805025-92	D4641VIB16		
9805025-93	D4664CYF10		
9805025-94	D4690CYF10		
9805025-95	D4700CYB10		
9805025-96	D4701CYB10		
9805025-97	D4705CYF10		
9805025-98	D4711THB10		
9805025-99	D4720THF10R		
9805025-100	D4736RAF10		
9805025-101	D4754RAS20		
9805025-102	D4768HIF16		
9805025-103	D4771VIF10		
9805025-104	D4773VIF10		
9805025-105	D3776WIF16		
9805025-106	D3781WIF10		
9805025-107	D3823HIF10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805025-108	D3827HIB10	Soil	Total metals analysis for As, Cd, and Pb
9805025-109	D3837HIF16		
9805025-110	D3843WIF10		
9805025-111	D4637CBF10		
9805025-112	D4691VIB16		
9805025-113	D4709CBB10		
9805025-114	D4711ELB10		
9805025-115	D4725RAF10		
9805025-116	D4731ELF10		
9805025-117	D4741ELF10		
9805025-118	D4751ELF10		
9805025-119	D4771ELB16		
9805025-120	D4786YIF10		

## DATA QUALITY STATEMENT

- ( ) Data are ACCEPTABLE according to EPA Functional guidelines with no qualifiers (flags) added by the reviewer.
- ( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
- ( X ) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes \_\_\_\_\_ No  X

TPO Attention Required? Yes \_\_\_\_\_ No  X  If yes, list the items that require attention:

## INORGANIC DATA QUALITY ASSURANCE REVIEW

## REVIEW NARRATIVE SUMMARY

This data package was reviewed according to "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," February 1994, modified for method use.

TDD No. 9712-0003 / 75-71203, Order No. 98-05-025 consisted of 120 soil samples for total metals analyses for arsenic, cadmium, and lead by SW-846 method 6010.

The following table lists the data qualifiers added to the sample analyses. Please see Data Qualifier Definitions, attached to the end of this report.

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
D4424MIF10, D4433MIB10, D4645MIB16, D4660MIB16, D4670MIB10, D4675MIB16, D4680MIF10, D4695MIB10, D4701MIF10, D4755MIF10, D4616RAB10, D4660RAB16, D4315SSF10, D4334SSB10, D4335SSB10, D4363SSF10, D4402SSB10, D4430SSF10, D4441SSB10, D4451SSF10, D4701SSB20, D4315STB16, D4363STB16, D4335THB16, D4435THB16, D4459THB10, D4625THS20, D4353VIS10, D4768VIS16, D3830WIF10, D3942WIF10, D3733WYB10, D3739WYB10, D3741WYB16, D4656YOB10, D3830HIB10, D4671VIG10, D4709RAB10, D4715CBF10, D4721RAF10D	Lead	J	Matrix spike % R outside QC criteria	IX
D4754RAS20, D4768HIF16, D4771VIF10, D4773VIF10, D3776WIF16, D3781WIF10, D3823HIF10, D3827HIB10, D3837HIF16, D3843WIF10, D4637CBF10, D4691VIB16, D4709CBB10, D4711ELB10, D4725RAF10, D4731ELF10, D4741ELF10, D4751ELF10, D4771ELB16, D4786YIF10	Cadmium			

Method/SOW Number 6010Revision 6010b

## Inorganic Deliverables Completeness Checklist

- P Inorganic Cover Page  
P Inorganic Analysis Data Sheets (Form I)  
P Initial Calibration and Calibration Verification Results (Form II)  
P Continuing Calibration Verification Results (Form II)  
NP CRDL Standard for ICP and AA (Form II, Part 2)  
P Blank Analysis Results (Form III)  
P ICP Interference Check Sample Results (Form IV)  
P Spiked Sample Results (Form V)  
P Post-digest Spiked Sample Analysis (Form V, Part 2)  
P Duplicate Sample Results (Form VI)  
P Instrument Detection Limits (Form VII) or (Form X - Quarterly)  
P Laboratory Control Sample results (Form VII)  
NA Standard Addition Results (Form VIII)  
P ICP Serial Dilution Results (Form IX)  
NA Holding Times Summary Sheet (Form X)  
P ICP Interelement Correction Factors (Form XII - Quarterly or Form XI - Annually)  
P ICP Linear Ranges (Form XII (XII) - Quarterly)  
P Raw Data  
P Samples P Calibration Standards P Blanks P Spikes  
P Duplicates P ICP QC (ICS and Serial Dilution) P LCS  
NA Fuñáce AA NA Mercury Analysis NA Cyanide Analysis  
NA Percent Solids Calculations - Solids Only  
P Sample Prep/Digestion Logs (Form XIII)  
P Analysis Run Log (Form XIV)  
P Chain-of-Custody  
P Sample Description  
P Case Narrative  
P Method References

## KEY:

- P = Provided in original data package, as required by the SOW  
R = Provided as Resubmission  
NP = Not provided in original data package or as resubmission  
NR = Not required under the SOW  
NA = Not applicable to this data package or analysis

## I. DELIVERABLES

All deliverables were present as specified in the Statement of Work (SOW).

Yes\_\_\_\_ No X

Comments: Summary forms for the CRDL standard (Form 2B equivalent) were not provided. Review of the data was completed using raw data and no further action was necessary.

The laboratory reported the instrument detection limit (IDL) equal to the CRDL. No action was required.

## II. HOLDING TIMES

All CLP-SOW holding times were met.

Yes X No\_\_\_\_

Comments: None.

All 40 CFR Part 136 technical holding times were met.

Yes X No\_\_\_\_

Comments: None.

## III. INSTRUMENT CALIBRATIONS: STANDARDS AND BLANKS

Initial instrument calibrations were performed according to SOW requirements.

Yes X No\_\_\_\_

Comments: None.

The instruments were calibrated daily and each time an analysis run was performed.

Yes X No\_\_\_\_

Comments: None.

The instruments were calibrated using one blank and the appropriate number of standards.

Yes X      No     

Comments:      None.

#### IV. FORM 1 - SAMPLE ANALYSIS RESULTS

Sample analyses were entered correctly on Form 1s.

Yes           No X

Comments:      The final results were reported on a wet weight basis.

Sample D4671VIG10 was incorrectly identified as D4674VIG10 on the summary forms. The sample number was corrected on the Form 1 and no further action was required.

#### V. FORM 2A - INITIAL AND CONTINUING CALIBRATION VERIFICATION

The initial and continuing calibration verification standards (ICV and CCV, respectively) met SOW requirements.

Yes X      No     

Comments:      None.

The calibration verification results were within 90-110% recovery for metals.

Yes X      No     

Comments:      None.

The continuing calibration standards were run at 10% frequency.

Yes X      No     

Comments:      None.



## VI. FORM 2B - CRDL STANDARD FOR ICP AND AA

ICP Analysis: Standards (CRI) at two times the CRDL or the IDL (whichever were greater) were analyzed at the beginning and the end of each sample run, or at a minimum of twice per eight hours, whichever was more frequent.

Yes X No     

Comments: The percent recovery for cadmium was 121% in the first CRI analysis and the recovery for lead was 128% in the third CRI analysis. These values were calculated from the raw data. No qualification was taken.

GFAA Analysis: Standards (CRA) at two times CRDL were analyzed at the beginning of each sample run.

Yes      No      NA X

Comments: None.

The CRI and/or the CRA were analyzed after the ICV.

Yes X No     

Comments: None.

## VII. FORM 3 - BLANKS

The initial and continuing calibration blanks (ICB and CCB, respectively) met SOW requirements.

Yes X No     

Comments: None.

The continuing calibration blanks were run at 10% frequency.

Yes X No     

Comments: None.

A laboratory/preparation blank was run at the frequency of one per twenty samples, or per sample delivery group (whichever is more frequent), and for each matrix analyzed.

Yes X No     

Comments: None.

All analyzed blanks were free of contamination.

Yes X No     

Comments: The blanks were reported to the IDL/CRDL. [Note: The IDL was equal to the CRDL.]

#### VIII. FORM 4 - ICP INTERFERENCE CHECK SAMPLE

The ICP interference check sample (ICS) was run twice per eight hour shift and/or at the beginning and end of each sample set analysis sequence (whichever is more frequent).

Yes X No     

Comments: None.

Percent recovery of the analytes in solution ICSAB were within the range of 80-120%.

Yes X No     

Comments: The summary form reported the incorrect true value for arsenic. The form indicated a true value of 500 ug/L, whereas the correct true value from the raw data reported a true value of 2000 ug/L. Additionally, the summary form did not provide percent recoveries for arsenic. Upon review of the data, all recoveries were found to be within acceptance criteria.

#### IX. FORM 5A - MATRIX SPIKE SAMPLE ANALYSIS

A matrix spike sample was analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X No     

Comments: None.

The percent recoveries (%R) were calculated correctly.

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result

SR = sample result

SA = spike added

Yes X No     

Comments: None.

Spike recoveries were within the range of 75-125% (an exception is granted where the sample concentration is four times the spike concentration).

Yes      No X

Comments: The following table lists the spike recoveries outside control limits, matrix, samples affected, and data qualifiers.

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Lead	137% / 196%	Soil	D4424MIF10, D4433MIB10, D4645MIB16, D4660MIB16, D4670MIB10, D4675MIB16, D4680MIF10, D4695MIB10, D4701MIF10, D4755MIF10, D4616RAB10, D4660RAB16, D4315SSF10, D4334SSB10, D4335SSB10, D4363SSF10, D4402SSB10, D4430SSF10, D4441SSB10, D4451SSF10, D4701SSB20, D4315STB16, D4363STB16, D4335THB16, D4435THB16, D4459THB10, D4625THS20, D4353VIS10, D4768VIS16, D3830WIF10, D3942WIF10, D3733WYB10, D3739WYB10, D3741WYB16, D4656YOB10, D3830HIB10, D4671VIG10, D4709RAB10, D4715CBF10, D4721RAF10D	J
Cadmium	74.2%	Soil	D4754RAS20, D4768HIF16, D4771VIF10, D4773VIF10, D3776WIF16, D3781WIF10, D3823HIF10, D3827HIB10, D3837HIF16, D3843WIF10, D4637CBF10, D4691VIB16, D4709CBB10, D4711ELB10, D4725RAF10, D4731ELF10, D4741ELF10, D4751ELF10, D4771ELB16, D4786YIF10	

**X. FORM 5B - POST DIGEST SPIKE RECOVERY**

A post-digest spike was performed for those elements that did not meet the specified criteria (i.e., pre-digestion/pre-distillation spike recovery falls outside of control limits and sample result is less than four times the spike amount added, exception: Ag, Hg).

Yes X      No           NA     

Comments:      None.

**XI. FORM 6 - DUPLICATE SAMPLE ANALYSIS**

Duplicate sample analysis was performed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X      No     

Comments:      None.

The RPDs were calculated correctly.

$$RPD = \frac{(S - D)}{(S + D)/2} \times 100$$

D = duplicate  
S = sample

The RPDs were calculated correctly.

Yes X      No           NA     

Comments:      None.

For sample concentrations greater than five times the CRDL, RPDs were within  $\pm 20\%$  (limits of  $\pm 35\%$  apply for soil/sediments/tailings samples).

Yes X      No           NA     

Comments:      None.

For sample concentrations less than five times the CRDL, duplicate analysis results were within the control window of  $\pm$  CRDL (two times CRDL for soils).

Yes X      No           NA     

Comments:      None.

**XII. GFAA QC**

Duplicate injections were performed on all GFAA samples and the RSD was within  $\pm 20\%$ .

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: None.

Analytical spikes were performed on all GFAA samples and the percent recovery was 85 - 115%.

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: None.

MSAs were analyzed when required and the correlation coefficient was  $> 0.995$ .

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: None.

**XIII. FORM 7 - LABORATORY CONTROL SAMPLE**

The laboratory control sample (LCS) was prepared and analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X No\_\_\_\_

Comments: None.

All results were within control limits.

Yes X No\_\_\_\_

Comments: None.

**XIV. FORM 8 - STANDARD ADDITION RESULTS**

Results from graphite furnace standard additions were entered on Form VIII as directed in the SOW.

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: None.

**XV. FORM 9 - ICP QC**

A serial dilution was performed for ICP analysis with every twenty or fewer samples of a similar matrix, or one per sample delivery group, whichever is more frequent.

Yes X      No \_\_\_\_      NA \_\_\_\_

Comments:      None.

The serial dilution was without interference problems as defined by the SOW.

Yes X      No \_\_\_\_      NA \_\_\_\_

Comments:      None.

**XVI. FORM 10 - QUARTERLY INSTRUMENT DETECTION LIMITS (IDL)**

IDLs were provided for all elements on the target analyte list.

Yes X      No \_\_\_\_

Comments:      The IDLs were determined just beyond three months of samples analysis. The IDL analysis was performed on 02/01/98, and the samples were analyzed on 05/14/98 and 05/15/98. No qualification was required.

**XVII. FORM 11 - INTERELEMENT CORRECTION FACTORS FOR ICP**

Interelement corrections for ICP were reported.

Yes X      No \_\_\_\_

Comments:      None.

**VIII. FORM 12 - ICP LINEAR RANGES**

ICP linear ranges were reported.

Yes X      No \_\_\_\_

Comments:      The ICP linear ranges were determined just beyond three months of samples analysis. The ICP linear range analysis was performed on 02/01/98, and the samples were analyzed on 05/14/98 and 05/15/98. No qualification was required.

**XIX. LINEAR RANGE VERIFICATION ANALYSIS**

Linear Range Verification Analysis (LRA) was performed and results were within control limits of  $\pm 5\%$  of the true value.

Yes\_\_\_ No\_\_\_ NA X

Comments: Linear range verification analysis was not provided.

**XX. FORM 13 - PREPARATION LOG**

Information on the preparation of samples for analysis was correctly reported on Form XIII.

Yes\_\_\_ No X

Comments: The preparation log Form 13 (page 190) did not include sample weights for samples D310047P10, D312047F10, and D4309CBF10. The weights were reported on the bench sheet and were used correctly to calculate the final results reported on the Form 1s.

The preparation log (page 246) incorrectly identified sample D4671VIG10 as D4674VIG10.

**XXI. FORM 14 - ANALYSIS RUN LOG**

A Form XIV with the required information was filled out for each analysis run in the data package.

Yes X No\_\_\_

Comments: None.

**XXII. Additional Comments or Problems/Resolutions not addressed above.**

Yes X No\_\_\_

Comments: The samples arrived at the laboratory at 23°C. Based on professional judgement, no qualification was taken.

The case narrative stated that sample D4425JOB10 was diluted 1:2 due to interfering analytes. However, sample D4419JOB10 rather than sample D4425JOB10 was diluted 1:2.

**INORGANIC DATA QUALITY ASSURANCE REVIEW****Region VIII****DATA QUALIFIER DEFINITIONS**

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality. Use of additional qualifiers should be carefully considered. Definitions for all qualifiers used should be provided with each report.

**GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA**

- R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.
- J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
- U J - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.
- N J - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.



## ACRONYMS

AA	Atomic Absorption
Ag	Silver
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRA	CRDL standard required for AA
CRDL	Contract Required Detection Limit
CRI	CRDL standard required for ICP
CV	Cold Vapor
EPA	U.S. Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
Hg	Mercury
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICSA	Interference Check Sample (Solution A)
ICSAB	Interference Check Sample (Solution AB)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LRA	Linear Range Verification Analysis
MSA	Method of Standard Additions
PDS	Post Digestion Spike
QC	Quality Control
RPD	Relative Percent Difference
RPM	Regional Project Manager
RSD	Percent Relative Standard Deviation
SA	Spike Added
SAS	Special Analytical Services
SDG	Sample Delivery Group
SOW	Statement of Work
SR	Sample Result
SSR	Spiked Sample Result
TPO	Technical Project Officer

## REGION VIII SUMMARY OF DATA QUALITY ASSURANCE REVIEW INORGANIC

TDD No.	Site Name		Operable Unit
9712-0003 / 75-71203	North Denver Soils		
RPM/OSC Name			
Peter Stevenson			
Contractor Laboratory	Contract No.	Order No.	Laboratory DPO/Region
Paragon Analytics, Inc.	Not Indicated	98-05-087	

Review Assigned Date May 28, 1998

Data Validator Amy Ballow

Review Completion Date June 5, 1998

Report Reviewer Bill Fear

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805087-1	D4680FIB16	Soil	Total metals analysis for As, Cd, and Pb
9805087-2	D4775FIF10		
9805087-3	D4710SCB10		
9805087-4	D4715SCB10		
9805087-5	D4725SCF10		
9805087-6	D4770SCB16		
9805087-7	D4760SCB16		
9805087-8	D4809CYF10		
9805087-9	D4811CYB10		
9805087-10	D4864CYG10		
9805087-11	D4841CYB16		
9805087-12	D4850CYF10		
9805087-13	D4921CYF10		
9805087-14	D4965CYB16		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805087-15	D270150F10	Soil	Total metals analysis for As, Cd, and Pb
9805087-16	D4801FIB10		
9805087-17	D4815FIF10		
9805087-18	D4820FIF10		
9805087-19	D4907FIF10		
9805087-20	D4923FIF10		
9805087-21	D5015FIB10		
9805087-22	D5071FIB10		
9805087-23	D4801MIF10		
9805087-24	D4809MIF10		
9805087-25	D4808MIF10		
9805087-26	D4912MIB10		
9805087-27	D4920MIF10		
9805087-28	D4921MIF10		
9805087-29	D4921MIB10		
9805087-30	D4924MIB10		
9805087-31	D4930MIB10		
9805087-32	D4972MIF10		
9805087-33	D5015MIG10 <sup>mv</sup> F10		
9805087-34	D4680YOF10		
9805087-35	D4325CYF10		
9805087-36	D4375CYS10		
9805087-37	D44343CYF10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805087-38	D4328CYF10	Soil	Total metals analysis for As, Cd, and Pb
9805087-39	D4400CYF10		
9805087-40	D4533CYF10		
9805087-41	<del>D4572CYS10</del> <sup>4512</sup> CYS10		
9805087-42	D282345F10		
9805087-43	D3702DEB16		
9805087-44	D3708DEB16		
9805087-45	D3742DEB10		
9805087-46	D3754DEF10R		
9805087-47	D3733WYB16		
9805087-48	D3934HUB16		
9805087-49	D121338B10		
9805087-50	D3795FRF10		
9805087-51	D4336STB10		
9805087-52	D4336STF10		
9805087-53	D4300CKF10		
9805087-54	D4330CKF16		
9805087-55	D4450ADB10		
9805087-56	<sup>4335</sup> <del>D4355</del> ADB10		
9805087-57	D3838STB10		
9805087-58	D4044STF10		
9805087-59	D4150ADF10		
9805087-60	D4130ADB10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805087-61	D4036ADV10	Soil	Total metals analysis for As, Cd, and Pb
9805087-62	D3910ADB10		
9805087-63	D3835ADF10		
9805087-64	D4070CKF10		
9805087-65	D4060CKB16		
9805087-66	D180144V18		
9805087-67	D4655FRV16		
9805087-68	D4639FRV14		
9805087-69	D4631FRB16		
9805087-70	D4619FRF10		
9805087-71	D4632FRS20		
9805087-72	D4660BAB10		
9805087-73	D4645BAB16		
9805087-74	D4615BAB10		
9805087-75	D4611BAB16		
9805087-76	D4764BAF10		
9805087-77	D4712BAB16		
9805087-78	D4535THB16		
9805087-79	D4763CBF20		
9805087-80	D4770CBF16		
9805087-81	D4655FIF10		
9805087-82	D4705FIF10		
9805087-83	D4669RAB10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805087-84	D4321STB16	Soil	Total metals analysis for As, Cd, and Pb
9805087-85	D4335STB16		
9805087-86	D4335MIF10		
9805087-87	D4543MIF10		
9805087-88	D4503FIB10		
9805087-89	D4442FIF10		
9805087-90	D4424FIB10		
9805087-91	D4460FIF10		
9805087-92	D4460FIF20		
9805087-93	D4325FIF10		
9805087-94	D4319FIF10		
9805087-95	D4653HIB10		
9805087-96	D4726HIF10		
9805087-97	D4775HIB10		
9805087-98	D4783HIF10R		
9805087-99	D4792HIF10		
9805087-100	D4786HIP10		
9805087-101	D4659WIF10		
9805087-102	D4708WIB16		
9805087-103	D4720WIB10		
9805087-104	D4730WIB10		
9805087-105	D4727WIF10		
9805087-106	D4727WIB16		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805087-107	D4738WIB16	Soil	Total metals analysis for As, Cd, and Pb
9805087-108	D4751WIF10		
9805087-109	D4750WIB10		
9805087-110	D4781WIS10		
9805087-111	D4753WIS10		
9805087-112	D4831ADF10		
9805087-113	D4841ADB16		
9805087-114	D4860ADF10		
9805087-115	D4860ADB10		
9805087-116	D4850ADF10		
9805087-117	D4800ADF10		
9805087-118	D4935ADF10		
9805087-119	D4959ADF10		
9805087-120	D4990ADF10		

## DATA QUALITY STATEMENT

- ( ) Data are ACCEPTABLE according to EPA Functional guidelines with no qualifiers (flags) added by the reviewer.
- ( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
- ( X ) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes \_\_\_\_\_ No X

TPO Attention Required? Yes \_\_\_\_\_ No X If yes, list the items that require attention:



## INORGANIC DATA QUALITY ASSURANCE REVIEW

### REVIEW NARRATIVE SUMMARY

This data package was reviewed according to "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," February 1994, modified for method use.

TDD No. 9712-0003 / 75-71203, Order No. 98-05-087 consisted of 120 soil samples for total metals analyses for arsenic, cadmium, and lead by SW-846 method 6010.

The following table lists the data qualifiers added to the sample analyses. Please see Data Qualifier Definitions, attached to the end of this report.

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
D4680FIB16, D4775FIF10, D4710SCB10, D4715SCB10, D4725SCF10, D4770SCB16, D4760SCB16, D4809CYF10, D4811CYB10, D4864CYG10, D4841CYB16, D4850CYF10, D4921CYF10, D4965CYB16, D270150F10, D4801FIB10, D4815FIF10, D4820FIF10, D4907FIF10, D4923FIF10	Lead	J	Matrix spike percent recovery less than acceptance criteria	IX
D4572CYS10, D282345F10, D3702DEB16, D3708DEB16, D3742DEB10, D3754DEF10R, D3733WYB16, D3934HUB16, D121338B10, D3795FRF10, D4336STB10, D4336STF10, D4300CKF10, D4330CKF16, D4450ADB10, D4355ADB10, D3838STB10, D4044STF10, D4150ADF10, D4130ADB10	Arsenic			
D5015FIB10, D5071FIB10, D4801MIF10, D4809MIF10, D4808MIF10, D4912MIB10, D4920MIF10, D4921MIF10, D4921MIB10, D4924MIB10, D4930MIB10, D4972MIF10, D5015MIG10, D4680YOF10, D4325CYF10, D4375CYS10, D44343CYF10, D4328CYF10, D4400CYF10, D4533CYF10	Lead			

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
D4659WIF10, D4708WIB16, D4720WIB10, D4730WIB10, D4727WIF10, D4727WIB16, D4738WIB16, D4751WIF10, D4750WIB10, D4781WIS10, D4753WIS10, D4831ADF10, D4841ADB16, D4860ADF10, D4860ADB10, D4850ADF10, D4800ADF10, D4935ADF10, D4959ADF10, D4990ADF10	Lead	J	Matrix spike percent recovery less than acceptance criteria	IX
D4572CYS10, D282345F10, D3702DEB16, D3708DEB16, D3742DEB10, D3754DEF10R, D3733WYB16, D3934HUB16, D121338B10, D3795FRF10, D4336STB10, D4336STF10, D4300CKF10, D4330CKF16, D4450ADB10, D4355ADB10, D3838STB10, D4044STF10, D4150ADF10, D4130ADB10	Lead	J	ICP serial dilution greater than the QC acceptance criteria of 10% and sample result greater than 50x the IDL	XV
D180144V18, D4655FRV16	Lead	Corrected results on Form 1s	Results incorrectly reported on Form 1s	XXII

Method/SOW Number ILM04.0Revision 0.0

## Inorganic Deliverables Completeness Checklist

- P Inorganic Cover Page  
P Inorganic Analysis Data Sheets (Form I)  
P Initial Calibration and Calibration Verification Results (Form II)  
P Continuing Calibration Verification Results (Form II)  
NP CRDL Standard for ICP and AA (Form II, Part 2)  
P Blank Analysis Results (Form III)  
P ICP Interference Check Sample Results (Form IV)  
P Spiked Sample Results (Form V)  
P Post-digest Spiked Sample Analysis (Form V, Part 2)  
P Duplicate Sample Results (Form VI)  
P Instrument Detection Limits (Form VII) or (Form X - Quarterly)  
P Laboratory Control Sample results (Form VII)  
NP Standard Addition Results (Form VIII)  
P ICP Serial Dilution Results (Form IX)  
NA Holding Times Summary Sheet (Form X)  
P ICP Interement Correction Factors (Form XII - Quarterly or Form XI - Annually)  
P ICP Linear Ranges (Form XII (XII) - Quarterly)  
P Raw Data  
    P Samples      P Calibration Standards      P Blanks      P Spikes  
    P Duplicates      P ICP QC (ICS and Serial Dilution)      P LCS  
    NA Furnace AA      NA Mercury Analysis      NA Cyanide Analysis  
NP Percent Solids Calculations - Solids Only  
P Sample Prep/Digestion Logs (Form XIII)  
P Analysis Run Log (Form XIV)  
P Chain-of-Custody  
P Sample Description  
P Case Narrative  
P Method References

## KEY:

- P = Provided in original data package, as required by the SOW  
R = Provided as Resubmission  
NP = Not provided in original data package or as resubmission  
NR = Not required under the SOW  
NA = Not applicable to this data package or analysis

## I. DELIVERABLES

All deliverables were present as specified in the Statement of Work (SOW).

Yes\_\_\_ No X

Comments: Summary forms for the CRDL standard (Form 2B equivalents) were not provided. Review of the data was completed using raw data and no further action was necessary.

The laboratory reported the instrument detection limit (IDL) equal to the CRDL. No action was required.

## II. HOLDING TIMES

All CLP-SOW holding times were met.

Yes X No\_\_\_

Comments: None.

All 40 CFR Part 136 technical holding times were met.

Yes X No\_\_\_

Comments: The sample cooler temperature upon receipt was 17 °C. Based on professional judgement, no action was taken.

## III. INSTRUMENT CALIBRATIONS: STANDARDS AND BLANKS

Initial instrument calibrations were performed according to SOW requirements.

Yes X No\_\_\_

Comments: None.

The instruments were calibrated daily and each time an analysis run was performed.

Yes X No\_\_\_

Comments: None.

The instruments were calibrated using one blank and the appropriate number of standards.

Yes X No     

Comments: None.

#### IV. FORM 1 - SAMPLE ANALYSIS RESULTS

Sample analyses were entered correctly on Form 1s.

Yes      No X

Comments: The final results were reported on a wet weight basis.

The EPA sample numbers reported on the Form 1s for samples D4330CKF16 and D4150ADF10 were incorrectly transcribed as D4300CKF16 and D4151APF10. The sample numbers were corrected on the Form 1s and no further action was required.

#### V. FORM 2A - INITIAL AND CONTINUING CALIBRATION VERIFICATION

The initial and continuing calibration verification standards (ICV and CCV, respectively) met SOW requirements.

Yes X No     

Comments: None.

The calibration verification results were within 90-110% recovery for metals.

Yes X No     

Comments: None.

The continuing calibration standards were run at 10% frequency.

Yes X No     

Comments: None.

## VI. FORM 2B - CRDL STANDARD FOR ICP AND AA

ICP Analysis: Standards (CRI) at two times the CRDL or the IDL (whichever were greater) were analyzed at the beginning and the end of each sample run, or at a minimum of twice per eight hours, whichever was more frequent.

Yes\_\_\_\_ No X

Comments: Summary forms (Form 2B equivalents) were not provided; however, the raw data were reviewed. According to the raw data, the CRI analyses were analyzed at the proper frequency.

GFAA Analysis: Standards (CRA) at two times CRDL were analyzed at the beginning of each sample run.

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: No GFAA sample analyses were performed for this data package.

The CRI and/or the CRA were analyzed after the ICV.

Yes X No\_\_\_\_

Comments: None.

## VII. FORM 3 - BLANKS

The initial and continuing calibration blanks (ICB and CCB, respectively) met SOW requirements.

Yes X No\_\_\_\_

Comments: None.

The continuing calibration blanks were run at 10% frequency.

Yes X No\_\_\_\_

Comments: None.

A laboratory/preparation blank was run at the frequency of one per twenty samples, or per sample delivery group (whichever is more frequent), and for each matrix analyzed.

Yes X No     

Comments: None.

All analyzed blanks were free of contamination.

Yes X No     

Comments: The blanks were reported to the IDL/CRDL [Note: The IDL was equal to the CRDL.]

## VIII. FORM 4 - ICP INTERFERENCE CHECK SAMPLE

The ICP interference check sample (ICS) was run twice per eight hour shift and/or at the beginning and end of each sample set analysis sequence (whichever is more frequent).

Yes X No     

Comments: None.

Percent recovery of the analytes in solution ICSAB were within the range of 80-120%.

Yes X No     

Comments: None.

## IX. FORM 5A - MATRIX SPIKE SAMPLE ANALYSIS

A matrix spike sample was analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X No     

Comments: None.

The percent recoveries (%R) were calculated correctly.

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result

SR = sample result

SA = spike added

Yes X No     

Comments: None.

Spike recoveries were within the range of 75-125% (an exception is granted where the sample concentration is four times the spike concentration).

Yes      No X

Comments: The following table lists the spike recoveries outside control limits, matrix, samples affected, and data qualifiers.

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Lead	64.8	Soil	D4680FIB16, D4775FIF10, D4710SCB10, D4715SCB10, D4725SCF10, D4770SCB16, D4760SCB16, D4809CYF10, D4811CYB10, D4864CYG10, D4841CYB16, D4850CYF10, D4921CYF10, D4965CYB16, D270150F10, D4801FIB10, D4815FIF10, D4820FIF10, D4907FIF10, D4923FIF10	J
Lead	74.6		D5015FIB10, D5071FIB10, D4801MIF10, D4809MIF10, D4808MIF10, D4912MIB10, D4920MIF10, D4921MIF10, D4921MIB10, D4924MIB10, D4930MIB10, D4972MIF10, D5015MIG10, D4680YOF10, D4325CYF10, D4375CYS10, D44343CYF10, D4328CYF10, D4400CYF10, D4533CYF10	



Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Lead	74.2	Soil	D4659WIF10, D4708WIB16, D4720WIB10, D4730WIB10, D4727WIF10, D4727WIB16, D4738WIB16, D4751WIF10, D4750WIB10, D4781WIS10, D4753WIS10, D4831ADF10, D4841ADB16, D4860ADF10, D4860ADB10, D4850ADF10, D4800ADF10, D4935ADF10, D4959ADF10, D4990ADF10	J
Arsenic	142.7		D4572CYS10, D282345F10, D3702DEB16, D3708DEB16, D3742DEB10, D3754DEF10R, D3733WYB16, D3934HUB16, D121338B10, D3795FRF10, D4336STB10, D4336STF10, D4300CKF10, D4330CKF16, D4450ADB10, D4355ADB10, D3838STB10, D4044STF10, D4150ADF10, D4130ADB10	

Various compounds were flagged "N" by the laboratory which indicates spiked sample recoveries were not within control limits. These compounds were evaluated by the laboratory utilizing different QC limits for the spike recoveries of 80-120%. All samples were evaluated for validation using the Functional Guideline QC limits of 75-125%.

The spike recoveries of lead in samples D4572CYS10 (46.9%, 31.4%) and D4659WIF10 (188%) were outside QC limits. No action was taken for lead in the associated samples because the sample concentrations exceeded the spike concentration by a factor greater than 4. The lead recoveries for all LCS analyses were within QC criteria.

#### X. FORM 5B - POST DIGEST SPIKE RECOVERY

A post-digest spike was performed for those elements that did not meet the specified criteria (i.e., pre-digestion/pre-distillation spike recovery falls outside of control limits and sample result is less than four times the spike amount added, exception: Ag, Hg).

Yes X No     

Comments: The post digestion spike recoveries were within QC limits.

**XI. FORM 6 - DUPLICATE SAMPLE ANALYSIS**

Duplicate sample analysis was performed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X No     

Comments: None.

The RPDs were calculated correctly.

$$RPD = \frac{(S - D)}{(S + D)/2} \times 100$$

S = sample  
D = duplicate

Yes X No     

Comments: None.

For sample concentrations greater than five times the CRDL, RPDs were within  $\pm 20\%$  (limits of  $\pm 35\%$  apply for soil/sediments/tailings samples).

Yes X No     

Comments: Arsenic was flagged "\*" by the laboratory in various samples, indicating that the RPD for the duplicate analyses were not within control limits. No action was necessary because the laboratory used the 20% criteria rather than the 35% criteria applied to soil samples for data validation.

For sample concentrations less than five times the CRDL, duplicate analysis results were within the control window of  $\pm$  CRDL (two times CRDL for soils).

Yes X No     

Comments: None.

**XII. GFAA QC**

Duplicate injections were performed on all GFAA samples and the RSD was within  $\pm 20\%$ .

Yes      No      NA X

Comments: No GFAA sample analyses were performed for this data package.

Analytical spikes were performed on all GFAA samples and the percent recovery was 85 - 115%.

Yes\_\_\_ No\_\_\_ NA\_X

Comments: No GFAA sample analyses were performed for this data package.

MSAs were analyzed when required and the correlation coefficient was  $> 0.995$ .

Yes\_\_\_ No\_\_\_ NA\_X

Comments: No GFAA sample analyses were performed for this data package.

### XIII. FORM 7 - LABORATORY CONTROL SAMPLE

The laboratory control sample (LCS) was prepared and analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes\_X No\_\_\_

Comments: None.

All results were within control limits.

Yes\_X No\_\_\_

Comments: None.

### XIV. FORM 8 - STANDARD ADDITION RESULTS

Results from graphite furnace standard additions were entered on Form VIII as directed in the SOW.

Yes\_\_\_ No\_\_\_ NA\_X

Comments: No GFAA sample analyses were performed for this data package.

**XV. FORM 9 - ICP QC**

A serial dilution was performed for ICP analysis with every twenty or fewer samples of a similar matrix, or one per sample delivery group, whichever is more frequent.

Yes X No     

Comments: None.

The serial dilution was without interference problems as defined by the SOW.

Yes      No X

Comments: The following serial dilution %Ds were greater than 10%.

Element	%Difference	Samples Affected	Qualifiers
Lead	10.7	D4572CYS10, D282345F10, D3702DEB16, D3708DEB16, D3742DEB10, D3754DEF10R, D3733WYB16, D3934HUB16, D121338B10, D3795FRF10, D4336STB10, D4336STF10, D4300CKF10, D4330CKF16, D4450ADB10, D4355ADB10, D3838STB10, D4044STF10, D4150ADF10, D4130ADB10	J

Various results were incorrectly flagged "E" by the laboratory, indicating that the reported value was estimated due to interferences associated with the serial dilution analyses. These incorrect "E" flags results were below the 50 time IDL action level and no action was necessary. The IDLs reported on the Form 10 were used to evaluate the ICP serial dilution. It should be noted that the IDL and CRDL reported on the Form 10 were the same value.

**XVI. FORM 10 - QUARTERLY INSTRUMENT DETECTION LIMITS (IDL)**

IDLs were provided for all elements on the target analyte list.

Yes X No     

Comments: The IDLs were determined just beyond three months of sample analysis. No qualification was required.

## XVII. FORM 11 - INTERELEMENT CORRECTION FACTORS FOR ICP

Interelement corrections for ICP were reported.

Yes X No     

Comments: None.

## XVIII. FORM 12 - ICP LINEAR RANGES

ICP linear ranges were reported.

Yes X No     

Comments: The ICP linear ranges were determined just beyond three months of sample analysis. No qualification was required.

## XIX. LINEAR RANGE VERIFICATION ANALYSIS

Linear Range Verification Analysis (LRA) was performed and results were within control limits of  $\pm 5\%$  of the true value.

Yes      No      NA X

Comments: Linear range verification analysis was not provided.

## XX. FORM 13 - PREPARATION LOG

Information on the preparation of samples for analysis was reported on Form XIII.

Yes X No     

Comments: None.

## XXI. FORM 14 - ANALYSIS RUN LOG

A Form XIV with the required information was filled out for each analysis run in the data package.

Yes X No     

Comments: None.

**XXII. Additional Comments or Problems/Resolutions not addressed above.**

Yes X No     

Comments: The results for lead in samples D3702DEB16, D180144V18, and D4655FRV16 exceeded the linear range and were reanalyzed at a 10 times dilution. The reported results for samples D180144V18 and D4655FRV16 were incorrectly reported. These lead results for were corrected on the Form 1s to 7980 mg/Kg and 5100 mg/Kg, respectively. The arsenic and cadmium results were reported from the original analyses.

**INORGANIC DATA QUALITY ASSURANCE REVIEW****Region VIII****DATA QUALIFIER DEFINITIONS**

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality. Use of additional qualifiers should be carefully considered. Definitions for all qualifiers used should be provided with each report.

**GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA**

- R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.
- J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
- U J - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.
- N J - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.

## ACRONYMS

AA	Atomic Absorption
Ag	Silver
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRA	CRDL standard required for AA
CRDL	Contract Required Detection Limit
CRI	CRDL standard required for ICP
CV	Cold Vapor
EPA	U.S. Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
Hg	Mercury
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICSA	Interference Check Sample (Solution A)
ICSAB	Interference Check Sample (Solution AB)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LRA	Linear Range Verification Analysis
MSA	Method of Standard Additions
PDS	Post Digestion Spike
QC	Quality Control
RPD	Relative Percent Difference
RPM	Regional Project Manager
RSD	Percent Relative Standard Deviation
SA	Spike Added
SAS	Special Analytical Services
SDG	Sample Delivery Group
SOW	Statement of Work
SR	Sample Result
SSR	Spiked Sample Result
TPO	Technical Project Officer



**REGION VIII  
SUMMARY OF DATA QUALITY ASSURANCE REVIEW  
INORGANIC**

TDD No.	Site Name	Operable Unit	
9712-0003 / 75-71203	North Denver Soils		
RPM/OSC Name			
Peter Stevenson			
Contractor Laboratory	Contract No.	Order No.	Laboratory DPO/Region
Paragon Analytics, Inc.	Not Indicated	98-05-180	

Review Assigned Date June 4, 1998Data Validator Amy BallowReview Completion Date June 10, 1998Report Reviewer Bill Fear

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805180-1	D190147F10	Soil	Total metals analysis for As, Cd, and Pb
9805180-2	D4701PA430		
9805180-3	D3801ARV10		
9805180-4	D3700WA430		
9805180-5	D4401CYV50		
9805180-6	D4690VIS10		
9805180-7	D4805RA410		
9805180-8	D4783HIB10		
9805180-9	D4979ADF10		
9805180-10	D5001ADF10		
9805180-11	D5020ADF10		
9805180-12	D5020ADB16		
9805180-13	D5030ADF10		
9805180-14	D5067ADF10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805180-15	D4859CKB16	Soil	Total metals analysis for As, Cd, and Pb
9805180-16	D4929CKF10		
9805180-17	D4940STF10		
9805180-18	D4970STB16		
9805180-19	D4974STB10		
9805180-20	D4980STF10		
9805180-21	D5016MIB10		
9805180-22	D5028MIF10		
9805180-23	D3527DEB16		
9805180-24	D3855CKB10		
9805180-25	D3808MAF10		
9805180-26	D3818MAF10		
9805180-27	D3849MAF26		
9805180-28	D3865MAF16		
9805180-29	D3861HAF10		
9805180-30	D3961HAB10		
9805180-31	D3906JAF10		
9805180-32	D3990JAB10		
9805180-33	D4111MAB16		
9805180-34	D4765SCF10		
9805180-35	D4545THF10		
9805180-36	D4625THF20		
9805180-37	D4783CLF10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805180-38	D4717BRB10	Soil	Total metals analysis for As, Cd, and Pb
9805180-39	D5102SSB10		
9805180-40	D5170SSB10		
9805180-41	D5195SSF10		
9805180-42	D4929STF10		
9805180-43	D4937STF10		
9805180-44	D5031STF10		
9805180-45	D3801COB10		
9805180-46	D3921COB10		
9805180-47	D4986STF10		
9805180-48	D4992STF10		
9805180-49	D5010STF10		
9805180-50	D5040STB10		
9805180-51	D5044STF10		
9805180-52	D5088STB10		
9805180-53	D3909CKF10		
9805180-54	D4720CLB10		
9805180-55	D4315THF10		
9805180-56	D5075MIB16		
9805180-57	D4909MIF10		
9805180-58	D4905MIF10		
9805180-59	D4809SSF10		
9805180-60	D4815SSF10		

Laboratory Sample ID	Sample Location	Matrix	Analysis
9805180-61	D5112FIF10	Soil	Total metals analysis for As, Cd, and Pb
9805180-62	D4914SSF10		
9805180-63	D4935SSF10		
9805180-64	D4965SSF10		
9805180-65	D5015SSF10		
9805180-66	D5063SSB16		
9805180-67	D5075SSB10		
9805180-68	D5096SSB10		

## DATA QUALITY STATEMENT

- ( ) Data are ACCEPTABLE according to EPA Functional guidelines with no qualifiers (flags) added by the reviewer.
- ( ) Data are UNACCEPTABLE according to EPA Functional Guidelines.
- ( X ) Data are acceptable with QUALIFICATIONS noted in review.

Telephone/Communication Logs Enclosed? Yes \_\_\_\_\_ No  X

TPO Attention Required? Yes \_\_\_\_\_ No  X  If yes, list the items that require attention:

## INORGANIC DATA QUALITY ASSURANCE REVIEW

## REVIEW NARRATIVE SUMMARY

This data package was reviewed according to "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," February 1994; modified for method use.

TDD No. 9712-0003 / 75-71203, Order No. 98-05-180 consisted 68 soil samples for total metals analyses for arsenic, cadmium, and lead by SW-846 method 6010.

The following table lists the data qualifiers added to the sample analyses. Please see Data Qualifier Definitions, attached to the end of this report.

Sample ID	Elements	Qualifiers	Reason for Qualification	Review Section
D5195SSF10, D4929STF10, D4937STF10, D5031STF10, D3801COB10, D3921COB10, D4986STF10, D4992STF10, D5010STF10, D5040STB10, D5044STF10, D5088STB10, D3909CKF10, D4720CLB10, D4315THF10, D5075MIB16, D4909MIF10, D4905MIF10, D4809SSF10, D4815SSF10	Arsenic	J	Matrix spike percent recovery greater than the acceptance criteria	IX

Method/SOW Number 6010Revision 6010B

## Inorganic Deliverables Completeness Checklist

P Inorganic Cover Page  
P Inorganic Analysis Data Sheets (Form I)  
P Initial Calibration and Calibration Verification Results (Form II)  
P Continuing Calibration Verification Results (Form II)  
NP CRDL Standard for ICP and AA (Form II, Part 2)  
P Blank Analysis Results (Form III)  
P ICP Interference Check Sample Results (Form IV)  
P Spiked Sample Results (Form V)  
P Post-digest Spiked Sample Analysis (Form V, Part 2)  
P Duplicate Sample Results (Form VI)  
P Instrument Detection Limits (Form VII) or (Form X - Quarterly)  
P Laboratory Control Sample results (Form VII)  
NA Standard Addition Results (Form VIII)  
P ICP Serial Dilution Results (Form IX)  
NA Holding Times Summary Sheet (Form X)  
P ICP Interelement Correction Factors (Form XII - Quarterly or Form XI - Annually)  
P ICP Linear Ranges (Form XII (XII) - Quarterly)  
P Raw Data  
    P Samples      P Calibration Standards      P Blanks      P Spikes  
    P Duplicates      P ICP QC (ICS and Serial Dilution)      P LCS  
    NA Furnace AA      NA Mercury Analysis      NA Cyanide Analysis  
NP Percent Solids Calculations - Solids Only  
P Sample Prep/Digestion Logs (Form XIII)  
P Analysis Run Log (Form XIV)  
P Chain-of-Custody  
P Sample Description  
P Case Narrative  
P Method References

## KEY:

P = Provided in original data package, as required by the SOW  
R = Provided as Resubmission  
NP = Not provided in original data package or as resubmission  
NR = Not required under the SOW  
NA = Not applicable to this data package or analysis

**I. DELIVERABLES**

All deliverables were present as specified in the Statement of Work (SOW).

Yes\_\_\_ No X

Comments: Summary forms for the CRDL standard (Form 2B equivalents) were not provided. Review of the data was completed using raw data and no further action was necessary.

**II. HOLDING TIMES**

All CLP-SOW holding times were met.

Yes X No\_\_\_

Comments: None.

All 40 CFR Part 136 technical holding times were met.

Yes X No\_\_\_

Comments: The sample cooler temperature upon receipt was 21°C. Based on professional judgement, no action was taken.

**III. INSTRUMENT CALIBRATIONS: STANDARDS AND BLANKS**

Initial instrument calibrations were performed according to SOW requirements.

Yes X No\_\_\_

Comments: None.

The instruments were calibrated daily and each time an analysis run was performed.

Yes X No\_\_\_

Comments: None.



The instruments were calibrated using one blank and the appropriate number of standards.

Yes X No     

Comments: None.

#### IV. FORM 1 - SAMPLE ANALYSIS RESULTS

Sample analyses were entered correctly on Form 1s.

Yes      No X

Comments: The final results were reported on a wet weight basis.

The EPA sample numbers reported on the Form 1s for samples D190147F10, D4401CYV50, D5016MIB10, D5195SSF10, and D5122FIF10 were incorrectly transcribed as D190147, D4401AYV50, D5016, D5195, and D5122, respectively. The sample numbers were corrected on the Form 1s and no further action was required.

#### V. FORM 2A - INITIAL AND CONTINUING CALIBRATION VERIFICATION

The initial and continuing calibration verification standards (ICV and CCV, respectively) met SOW requirements.

Yes X No     

Comments: None.

The calibration verification results were within 90-110% recovery for metals.

Yes X No     

Comments: None.

The continuing calibration standards were run at 10% frequency.

Yes X No     

Comments: None.

**VI. FORM 2B - CRDL STANDARD FOR ICP AND AA**

ICP Analysis: Standards (CRI) at two times the CRDL or the IDL (whichever were greater) were analyzed at the beginning and the end of each sample run, or at a minimum of twice per eight hours, whichever was more frequent.

Yes\_\_\_\_ No X

Comments: Summary forms (Form 2B equivalents) were not provided; however, the raw data were reviewed. According to the raw data, the CRI analyses were analyzed at the proper frequency.

GFAA Analysis: Standards (CRA) at two times CRDL were analyzed at the beginning of each sample run.

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: No GFAA sample analyses were performed for this data package.

The CRI and/or the CRA were analyzed after the ICV.

Yes X No\_\_\_\_

Comments: None.

**VII. FORM 3 - BLANKS**

The initial and continuing calibration blanks (ICB and CCB, respectively) met SOW requirements.

Yes X No\_\_\_\_

Comments: None.

The continuing calibration blanks were run at 10% frequency.

Yes X No\_\_\_\_

Comments: None.

A laboratory/preparation blank was run at the frequency of one per twenty samples, or per sample delivery group (whichever is more frequent), and for each matrix analyzed.

Yes X No     

Comments: None.

All analyzed blanks were free of contamination.

Yes X No     

Comments: None.

#### VIII. FORM 4 - ICP INTERFERENCE CHECK SAMPLE

The ICP interference check sample (ICS) was run twice per eight hour shift and/or at the beginning and end of each sample set analysis sequence (whichever is more frequent).

Yes X No     

Comments: None.

Percent recovery of the analytes in solution ICSAB were within the range of 80-120%.

Yes X No     

Comments: None.

#### IX. FORM 5A - MATRIX SPIKE SAMPLE ANALYSIS

A matrix spike sample was analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X No     

Comments: None.

The percent recoveries (%R) were calculated correctly.

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

SSR = spiked sample result

SR = sample result

SA = spike added

Yes X No     

Comments: None.

Spike recoveries were within the range of 75-125% (an exception is granted where the sample concentration is four times the spike concentration).

Yes      No X

Comments: The following table lists the spike recoveries outside control limits, matrix, samples affected, and data qualifiers.

Element	Spike Recovery	Matrix	Samples Affected	Qualifiers
Arsenic	256.5, 135.8	Soil	D5195SSF10, D4929STF10, D4937STF10, D5031STF10, D3801COB10, D3921COB10, D4986STF10, D4992STF10, D5010STF10, D5040STB10, D5044STF10, D5088STB10, D3909CKF10, D4720CLB10, D4315THF10, D5075MIB16, D4909MIF10, D4905MIF10, D4809SSF10, D4815SSF10	J

The spike recoveries of lead in samples D5016MIB10MS (130.7%), D5195SSF10MS (125.6%), and D5196MSD (127.5%) were outside QC limits. No action was taken for lead in the associated samples because the sample concentrations exceeded the spike concentration by a factor greater than 4. The lead recoveries for all LCS analyses were within QC criteria.

#### X. FORM 5B - POST DIGEST SPIKE RECOVERY

A post-digest spike was performed for those elements that did not meet the specified criteria (i.e., pre-digestion/pre-distillation spike recovery falls outside of control limits and sample result is less than four times the spike amount added, exception: Ag, Hg).

Yes X No     

Comments: The post digestion spike recoveries were within QC limits.

**XI. FORM 6 - DUPLICATE SAMPLE ANALYSIS**

Duplicate sample analysis was performed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes X No     

Comments: None.

The RPDs were calculated correctly.

$$RPD = \frac{(S - D)}{(S + D)/2} \times 100$$

S = sample

D = duplicate

Yes X No     

Comments: None.

For sample concentrations greater than five times the CRDL, RPDs were within  $\pm 20\%$  (limits of  $\pm 35\%$  apply for soil/sediments/tailings samples).

Yes X No     

Comments: The case narrative indicated that the RPD for arsenic in the duplicate analysis of sample D5195SSF10MSD (27.6%) was not within control limits. No action was necessary because the laboratory used the 20% criteria rather than the 35% criteria applied to soil samples for data validation.

For sample concentrations less than five times the CRDL, duplicate analysis results were within the control window of  $\pm$  CRDL (two times CRDL for soils).

Yes X No     

Comments: None.

**XII. GFAA QC**

Duplicate injections were performed on all GFAA samples and the RSD was within  $\pm 20\%$ .

Yes      No      NA X

Comments: No GFAA sample analyses were performed for this data package.

Analytical spikes were performed on all GFAA samples and the percent recovery was 85 - 115%.

Yes\_\_\_\_ No\_\_\_\_ NA\_X

Comments: No GFAA sample analyses were performed for this data package.

MSAs were analyzed when required and the correlation coefficient was  $> 0.995$ .

Yes\_\_\_\_ No\_\_\_\_ NA\_X

Comments: No GFAA sample analyses were performed for this data package.

### XIII. FORM 7 - LABORATORY CONTROL SAMPLE

The laboratory control sample (LCS) was prepared and analyzed with every twenty or fewer samples of a similar matrix, or one per sample delivery group (whichever is more frequent).

Yes\_X No\_\_\_\_

Comments: None.

All results were within control limits.

Yes\_X No\_\_\_\_

Comments: None.

### XIV. FORM 8 - STANDARD ADDITION RESULTS

Results from graphite furnace standard additions were entered on Form VIII as directed in the SOW.

Yes\_\_\_\_ No\_\_\_\_ NA\_X

Comments: No GFAA sample analyses were performed for this data package.

**XV. FORM 9 - ICP QC**

A serial dilution was performed for ICP analysis with every twenty or fewer samples of a similar matrix, or one per sample delivery group, whichever is more frequent.

Yes X No     

Comments: None.

The serial dilution was without interference problems as defined by the SOW.

Yes X No     

Comments: None.

**XVI. FORM 10 - QUARTERLY INSTRUMENT DETECTION LIMITS (IDL)**

IDLs were provided for all elements on the target analyte list.

Yes X No     

Comments: The IDLs were determined just beyond three months of sample analysis. No qualification was required.

**XVII. FORM 11 - INTERELEMENT CORRECTION FACTORS FOR ICP**

Interelement corrections for ICP were reported.

Yes X No     

Comments: None.

**XVIII. FORM 12 - ICP LINEAR RANGES**

ICP linear ranges were reported.

Yes X No     

Comments: The ICP linear ranges were determined just beyond three months of sample analysis. No qualification was required.

**XIX. LINEAR RANGE VERIFICATION ANALYSIS**

Linear Range Verification Analysis (LRA) was performed and results were within control limits of  $\pm 5\%$  of the true value.

Yes\_\_\_\_ No\_\_\_\_ NA X

Comments: Linear range verification analysis was not provided.

**XX. FORM 13 - PREPARATION LOG**

Information on the preparation of samples for analysis was reported on Form XIII.

Yes X No\_\_\_\_

Comments: None.

**XXI. FORM 14 - ANALYSIS RUN LOG**

A Form XIV with the required information was filled out for each analysis run in the data package.

Yes X No\_\_\_\_

Comments: None.

**XXII. Additional Comments or Problems/Resolutions not addressed above.**

Yes X No\_\_\_\_

Comments: The results for lead in samples D3865MAF16, D4717BRB10, and D5088STB10; and the results for cadmium in samples D4717BRB10 and D5088STB10 were reported from the diluted analyses of 10 times and two times, respectively. All other target elements results for these analyses were reported from the original runs.



**INORGANIC DATA QUALITY ASSURANCE REVIEW****Region VIII****DATA QUALIFIER DEFINITIONS**

For the purpose of Data Validation, the following code letters and associated definitions are provided for use by the data validator to summarize the data quality. Use of additional qualifiers should be carefully considered. Definitions for all qualifiers used should be provided with each report.

**GENERAL QUALIFIERS for use with both INORGANIC and ORGANIC DATA**

- R - Reported value is "rejected." Resampling or reanalysis may be necessary to verify the presence or absence of the compound.
- J - The associated numerical value is an estimated quantity because the Quality Control criteria were not met.
- U J - The reported amount is estimated because Quality Control criteria were not met. Element or compound was not detected.
- N J - The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
- N - The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.

## ACRONYMS

AA	Atomic Absorption
Ag	Silver
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRA	CRDL standard required for AA
CRDL	Contract Required Detection Limit
CRI	CRDL standard required for ICP
CV	Cold Vapor
EPA	U.S. Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
Hg	Mercury
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
ICSA	Interference Check Sample (Solution A)
ICSAB	Interference Check Sample (Solution AB)
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
LRA	Linear Range Verification Analysis
MSA	Method of Standard Additions
PDS	Post Digestion Spike
QC	Quality Control
RPD	Relative Percent Difference
RPM	Regional Project Manager
RSD	Percent Relative Standard Deviation
SA	Spike Added
SAS	Special Analytical Services
SDG	Sample Delivery Group
SOW	Statement of Work
SR	Sample Result
SSR	Spiked Sample Result
TPO	Technical Project Officer